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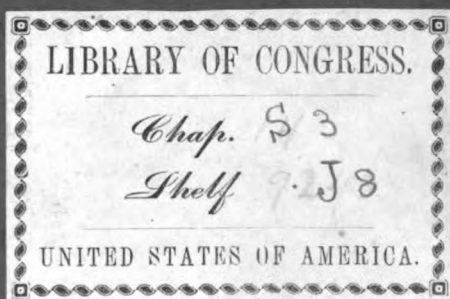
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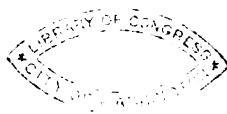
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THE
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JULY 1863—MARCH 1865.

NEW SERIES.



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THE JOURNAL OF AGRICULTURE.

THE PLOUGH AND PLOUGHING.

BY AN OLD NORFOLK FARMER.

It is the general, and most probably the correct, opinion, that the spade was the first manufactured implement of husbandry for the cultivation or "tillage" of the soil. In that case it is rational to suppose that it was made of wood, hardened in the fire, and sharpened at the end to a point or edge. This is still the practice in the interior of Africa; and when the island of Madagascar was first discovered by Europeans, about the middle of the seventeenth century, though the land was regularly cultivated, no other implement was used but a stick thus hardened in the fire; for, although there was an abundance of oxen in the island, none had ever been used in labour of any kind. The use of iron, according to the sacred writings, appears not to have been invented until the time of Tubal-Cain, who, by the same authority, was born about 130 years after the creation of man, and became the instructor of all those who worked in brass and iron. When the plough was invented, and the employment of oxen to draw it came into use, it is impossible to say; but it must have been soon after the Flood, if not before that event (which is the most probable), for we find early mention of it in Scripture as the common implement of husbandry.

The antiquity, then, of the plough, carries us back to patriarchal times, and the application of animal power to draw it was undoubtedly coeval with its invention, there being the same reason for the employment of both,—the saving of manual labour. If we may judge from the drawings and engravings which have been handed down to us, the ancient plough was a very simple, and, according to our modern ideas, a very inefficient implement—calculated rather to stir or grub up the soil than to turn it over in a furrow-slice. Even the ploughs of the Egyptians, Greeks, and Romans, according to the representations of these on medals, sculptures, and other works of art still extant, were of the rudest and simplest construc-

tion. The share was a piece of hard wood of an angular form, probably tipped with iron. This was fixed into a bar of wood, to which was also morticed the stilt or handle. It was drawn by two oxen, guided by the ploughman with a staff or pole, who also steadied the plough with the stilt. A still more simple form of plough was in use in some parts of the continent of India and China. It was in the shape of an anchor, one of the flukes being used in stirring the soil, while the other formed the handle held by the ploughman. It was drawn by two oxen yoked to the shank, which was curved forward for the purpose. These implements appear to us very ill adapted to the purpose, and yet the husbandmen of those days and those countries managed to grow excellent crops of grain, especially the Egyptians, who, if we are to believe ancient authors, obtained a return of wheat, the abundance of which would make even an enlightened English farmer open his eyes wide with astonishment.

It is quite in accordance with the practice of the ancient Romans that they should have introduced their model plough into Britain at the time of the Conquest. The representations we have of it on coins and medals, impress us with the idea that it was laborious both to the cattle and the ploughman, especially when it was drawn by the tails of the oxen, as was formerly the case in England, and certainly in Ireland so late as the seventeenth century, when an Act of the Irish Parliament was passed to prohibit the practice. Until the middle of the last century, the English plough was a heavy cumbrous implement, and the Scottish not much better. Oxen were chiefly employed in that country, and as many as ten were sometimes attached to a plough, and never less than six or eight. Things are materially altered in that part of the kingdom, since Lord Kames, in his 'Gentleman Farmer,' exposed the defects of the Scottish husbandry, and recommended his countrymen to adopt the English practice.

In England, a complete revolution has been effected in the form of the ploughs, as well as in the material of which they are composed. Agricultural Shows, and vigorous competition, have stimulated the ingenuity of the machinists to the utmost; and the dogmatic opinions enunciated by the constituted judges of what a plough should be, and the work it should perform, have led them to refine upon the construction of it to such an extent as to raise the question, whether they have not lost sight of the most important object the farmer should have in view in the tillage of his field—*the most expeditious and effectual comminution of the soil, and its conversion into a seed-bed?* Let us, therefore, inquire how far this primary object has been kept in view and promoted by the refinement and elegance introduced of late years into the construction and form of this implement.

If I may judge from the style of work of the modern ploughs (and nothing can present a more beautiful appearance) at the vari-

ous competitive trials, and the decisions of the judges, the principal points to which their attention is directed are, first, *to produce a continuously smooth and unbroken furrow-slice lying at an angle of forty-five degrees; and, secondly, to effect this at the smallest expenditure of power.* The first of these objects has been openly avowed or tacitly approved of by the judges, consequently the machinists have exercised all their science and ingenuity to ascertain the exact length and curve of mould-board best calculated to combine the two, showing a furrow-slice "*without even a crack*" (this was the language of one of the judges), and with the least amount of force in its execution. Whether the first of these objects is compatible with that of producing expeditiously a seed-bed is the question to be considered.

The defects of the common plough as the implement of cultivation have long been seen and felt by reflecting agriculturists. Forsyth, at the beginning of the present century, wrote on it as follows:—

"There is not any invention of man that more highly merits our utmost endeavours to bring it to perfection, but it has been too much neglected by those persons who study mechanics, and has been considered as a rude tool unworthy of their attention. Anything appears to them sufficient for the clumsy task of turning up the ground; and they cannot imagine that there can be any nicety in a business which is successfully performed by the ignorant peasant. Others acknowledge the value of the machine and the difficulty of the subject; but they think that difficulty insuperable, because the operation is so complicated, and the resistance to be overcome so uncertain, or so little understood, that we cannot discover any unequivocal principle, and must look for improvement from experience or chance.

"But these opinions are ill-founded. The difficulty is indeed great, and it is neither from the ignorant farmer nor the rude artist that we can expect improvement. It requires the serious consideration of the most accomplished mechanic; but from him we *may* expect improvement. We have many data; we know pretty distinctly what preparation will fit the ground for being the proper receptacle for the seed and for supporting and nourishing the plant. And though it is perhaps impossible to bring it into this state by the operation of any instrument of the plough kind, we know that some ploughs prodigiously excel others in reducing the stiff ground to that uniform crumbling state in which it can be left by the spade. The imperfection of their performances, or what yet remains to be done to bring the ground to this state, is distinctly understood. It seems, then, a determinate problem (to use the language of mathematicians), because the operation depends on the invariable laws of mechanical nature."*

The writer here expressly declares the principle we have laid down above, but at the same time despairs of seeing a plough produced that will affect it. "We do not aim," he subsequently remarks, "at reducing the ground to that pliable and uniform state into which we can bring it with the spade; but we wish to bring it into such a state that the ordinary operations of the season will complete the task." If the land, after being ploughed, has to

* 'The Principles and Practice of Agriculture Explained.' Vol. i. p. 223.

remain any length of time, it is true that the season *will* reduce the hard upturned furrow-slice to a state in which further operations will effect with comparative ease its comminution. But what of the clover leys sown with wheat in the autumn upon the upturned flags without any other preparation? and ploughed, too, upon the new principle laid down by the judges—of a “furrow-slice without a crack in it,” a hard, continuous, square mass of clay, the upward edge well defined, and the surface smooth and perfect as a brick just turned out of the mould, for such, in plain phrase, is the ideal perfection of ploughing in the estimation of the judges? And this, too, must undergo the operation of rolling before the drill or the dibble can deposit the seed; and thus, instead of comminution, to form a seed-bed, the soil is rendered as hard and unfit for that use as the art and implements of the farmer can make it.

We don't blame the makers of the modern ploughs for thus producing instruments perfectly adapted to carry out the absurd ideas of the judges. Few of them are farmers, and still fewer have been able to grasp the idea of reducing the soil by one operation into a receptacle for the seed. Besides, the express *dictum* of the judges, who are supposed to be well acquainted with the requirements in the operations of the plough, have led them astray; and so imperious have been the laws laid down for their guidance in respect to the form of the furrow-slice, that any deviation from it towards a more rational system was sure to incur failure with the judges. . An instance of this kind was seen at the Show of the Royal Agricultural Society of England at Warwick, where the only plough which was capable of reducing and comminuting the stubborn and sun-baked soil was absolutely turned out of the trial ground,* although no other implement would bear a comparison with it for utility. What then could the machinists do but attend to the instructions or laws enacted by the judges, and further subscribed to by the body of agriculturists, who appear to be wholly unconscious of the possibility of overcoming the “difficulty” referred to by Forsyth, and by him pronounced almost, if not quite, insurmountable?

Light, however, has been thrown upon this subject within the last few years by the persevering efforts of Mr Smith of Woolston, the inventor of the “smashing-up” system of cultivation, as he quaintly terms it. In other words, by a powerful cultivator or grubber, worked by steam, he tears the soil into fragments by a single operation to the depth of from six to sixteen inches. That Mr Smith

* This was Hancock's plough. The writer saw it at work at Warwick on another field—a hard “Olland” or two-years' ley, which it broke up with ease by one operation. This plough has three shares—the first takes off about two inches of the turf, which it turns into the bottom of the furrow; the second and third take three inches each, and the whole is broken into a crumbly state adapted for immediate sowing.

has struck into the right path is proved by the readiness with which many machinists, as well as farmers, have followed him. One of the former, in a letter to the writer, has expressed himself in the following manner on this subject:—

“Very considerable progress has been made during the last two years, not only on the mechanical appliances for steam-culture, but also in the development of steam as a motive power for cultivating the soil. A great revolution has also taken place during the same time in the ideas of farmers upon the question of the relative value of ploughing or inverting the land, and the breaking up or cultivating it. And although the simple smashing or breaking up of the soil by the tines of a cultivator was but little appreciated, there can be no question that the opinion of those best qualified to judge—viz. those who have adopted steam-power for cultivating, is now *decidedly in favour of the cultivator over the plough.*”

If the cultivator is so superior to the plough under steam-power, I ask, why should it not be so under animal-power also? The necessity of a perfect pulverisation is as great in the one case as in the other; but it is too early in the day for a machinist, and, *par excellence*, a plough-manufacturer, although an extensive farmer as well, to go so far as that.

Mr Morton, in his ‘Cyclopædia of Agriculture,’ has touched, although very gently, on the same subject. He says:—

“We need not state here the condition in which land ought to be left by the plough, either when it is intended for a seed-bed, or that it may be more speedily prepared for one. Both the farmer and the philosopher agree on this point. Whether the question be looked at by the eye of the practical or of the scientific man, the answer given by each is the same in fact, however different the verbiage may be in which it is expressed. The one says the land should be in sound heart and healthy condition; and the other means the very same thing when he says that it should be in such a state that free access is given to air and moisture, by which the manure and the soil may be rapidly decomposed, or the germination of the seed rapidly effected.

“Now, in considering what mode of ploughing will most rapidly and effectually bring land into this condition, it is evident that we cannot reason from the operation as performed on land already in a loose state; there, indeed, no difference will be perceptible between the work of two very different implements. If we are to compare the work of two ploughs, it must be done on such land, that the form and position of the sods, as each is cut and turned over, will be preserved.”

Mr Morton speaks here, we presume, of a clover-ley of one or two years’ standing, ploughed up at Michaelmas for dibbling or drilling with wheat. It is evident, however, that at the close of the quotation he completely loses sight of the object with which he set out, when he stated it to be the aim both of the farmer and the philosopher *speedily* to prepare a seed-bed. If the “form of the sod” is to be preserved in turning over, which is the avowed object both of the judges and the machinists, the speedy preparation of the seed-bed is sacrificed to the mere appearance of the surface; and whilst a well-pulverised soil is admitted to be an essential con-

dition of a proper seed-bed, the preservation of the form of the sod, which presents it in one *hard, elongated, smooth, and unbroken furrow-slice*, leaves it in a very unfit state for the purpose.

It is abundantly evident, however, from the allusions contained in the quotations we have given, that the public mind is being prepared for a great change in the system of cultivation; and that, in connection with drainage, subsoiling, and, above all, steam-culture, the construction of the plough will have to undergo another modification in order to adapt it to the new ideas on the subject. I have no hesitation in saying that the unbroken furrow-slice, as a test of superior excellence, *must be given up by the judges* at our competitive trials, and the most speedy and complete pulverisation of the soil at the least expenditure of power substituted. This, it is true, is of less consequence in cases where the land is laid up for the winter, because time is then given for the action of frost, and snow, and rain, and other atmospheric agents upon the soil, which of themselves help to disintegrate and reduce it to the proper condition. But even in this case the opening up of the soil by a primary pulverisation would answer the purpose far better by admitting the air into every part of it, and thus facilitate and hasten the final and complete preparation of the seed-bed. The deeper this aëration of the soil is effected the greater will be the benefit to the intended crop. It not only prevents the retention of rain-water on the surface, but it admits the light and warmth of the sun during the day, and the dews at night—all tending still further to that comminution which is the ultimate object of tillage.

I must not dismiss the subject of ploughs without noticing a remarkable implement invented some years since by the Marquess of Tweeddale at Yester, and through the success with which its employment has been attended on the estate of that nobleman, has been extensively adopted in Scotland. I shall give a description of this plough, which, as will be seen, was intended for deep culture in order to stir the subsoil, and thus acquire a deeper bed for the plants; but which, at the same time, produced a thorough pulverisation of the soil by one operation, through the way in which the furrow-slice was delivered from the mould-board. The account I shall give of this plough is taken from a small treatise on the 'Yester Deep Land-Culture,' drawn up by Mr Stephens, the author of other well-known and excellent agricultural works, 'The Book of the Farm,' 'The Book of Farm Implements,' &c., published by William Blackwood and Sons, Edinburgh and London.

It appears that the Marquess of Tweeddale, who is himself a first-rate husbandman (I cannot give him a more honourable title), became dissatisfied with the ordinary mode of ploughing to the depth only of 6 or 8 inches, practised at Yester on his estate, of which he held about 970 acres, divided into three farms, in his own hands. He accordingly directed his steward to have the depth increased,

with the common plough of the country and four horses, to 12 or 14 inches. It was found, however, that such was the strain upon the ploughman's arms, that it was next to impossible for him to retain the plough in its proper position; while, on the other hand, it was equally oppressive to the horses, the least obstruction throwing them out, tearing the harness, breaking the swing-trees, and sometimes even the plough. The Marquess, therefore, made the subject his study, and with the assistance of his ploughmen, whom he did not disdain to admit into his counsel on the occasion, he produced an implement for which his country will have good reason to honour his memory. The following was the mode in which the Marquess proceeded:—

“It was conjectured that a convex form of mould-board would effect the purpose, and it was constructed in the following manner. A mould-board of convex shape was formed of wood. Veneers of wood were nailed on this mould-board where it was thought it was too lean, and the wood was reduced where the mould-board was thought too full. The grieve (or bailiff), mechanic, and ploughmen, were then consulted as to their idea of the form of the mould-board, and on their all agreeing, the plough was used with the wooden mould-board. When the form of this was approved of on trial, a sheet of lead was laid on it, and beaten into its shape. A coating of iron was then made from the leaden mould, and the iron mould-board was tried on the plough. Alterations to effect the purpose in view, under the guidance of the above parties, were carried out; and by repeated trials in this fashion, at least twenty in number, a mould-board that could lay a furrow-slice according to the model, was at last attained.

“The model furrow-slice was obtained by the experiment of digging a furrow with the spade, and laying a furrow-slice in such a position as was wished to be done with the mould-board of the plough. The wall of the furrow (on the land-side) was cut perpendicular, and the floor made flat. A form of mould-board that fitted the space prepared by the spade was accordingly made of wood, and its practical effect was immediately tested as described above; and one modification in it after another was suggested, with so much perseverance, that the altered mould-board was worked with in the forenoon, while the suggested modification was made on it in the afternoon, arising from the trial of the alteration in the course of the forenoon. Thus a form of mould-board was ultimately obtained which allows four horses to draw the plough through soil of the same description at the depth of fifteen inches, with as much ease to men and horses as the common plough is drawn at the depth of ten inches with two horses. The secret of the matter seems to be that the improved mould-board, *instead of pressing against the furrow-slice, separates it at once from the land-side with its breast*, which is the only point of resistance, and causes it to slip along a straight inclined plane, from the point of the sock to the ear of the mould-board, on reaching which, it falls away by its own gravity. Friction against the mould-board is thus in great measure avoided. The deep-plough with four horses, clears a furrow of 15 or 16 inches in depth, and 14 inches in breadth. It cuts the furrow square on the land-side, and makes the soil flat and smooth, &c.”

Two men are required when working with four horses—one to drive and another to hold, *literally*; for it requires no effort to guide it, as they can temper the irons in such a way as to enable

the plough to go twenty or thirty yards without holding the stilts at all. It will plough an acre in a day of ten hours.

But, in addition to this plough, the Marquess, not satisfied with the depth of 16 inches, has invented a subsoil plough of very simple construction, worked also with four horses, in the furrow made by the Tweeddale plough, going 4 or 5 inches below it, and bringing up the subsoil upon a tail-board on an inclined plane attached to the sock. By this means the subsoil and the upper soil are mingled together, and left by the two implements in a completely pulverulent condition. The sock or share is feather-edged on both sides, the more effectually to stir the subsoil, and the tail-board is 7 inches wide and 18 inches long, and is elevated 9 inches at the hinder end, from which the subsoil, after sliding up the inclined plane, is thrown over, mixing with the upper soil, which is partly disturbed at the same time.

Mr Stephens very justly ascribes the benefit of this deep-culture to its being associated with thorough-draining; and is of opinion that if so large a portion of the subsoil were brought up on undrained land, it would be injurious to a white crop. This he accounts for by the presence of oxide of iron in the subsoil, which in undrained land is in a state of protoxide; this is soluble in water, and is always injurious to vegetation; but wherever land is thorough-drained, the protoxide is converted into peroxide* by the action of the air, and being insoluble in water, is rendered innoxious to vegetation.

The entire expense of these combined operations on the Marquess's estate was L.2, 13s. per statute acre, reckoning 12s. per day for a man and one pair of horses, and 5s. per day for removing stones. This latter, however, would not be required on the generality of farms, except in the mountainous part of the country, where boulders prevail in almost every field.

It is evident that the mass of earth turned over by these ploughs—namely, 16 inches by 14 by the first, and 4 or 5 by 14 with the other—can never present a furrow-slice of a square and compact form, such as the Judges of the Royal Agricultural Society delight in and patronise. Talk of “smashing up” the soil by the cultivator, after the Tweeddale system of tillage! why, it is child's play to it; and what the Tweeddale system will effect when steam power is applied to it, is impossible to guess; but that steam power will work wonders with it there can be no question, because, wherever it has been introduced, it has proved both more effective and more economic than animal power.

The advantages of subsoil trench-ploughing and thorough-draining—for Mr Stephens considers the success of the first dependent on the second—he thus sums up:—

* *Protoxide* is a substance combined with oxygen in the first or slightest degree. *Peroxide* is the same, having a maximum of oxygen—the highest oxide of any metal.

"The land being laid dry, it may be cross-ploughed in the autumn, and being left for the winter, requires no further work till being prepared for potatoes or turnips in the spring, which is both a saving of labour and the avoidance of treading and poaching the land; deep-rooted weeds are eradicated; the pulverisation of the soil and subsoil is completely and permanently effected; less manure is required to raise the former amount of produce; the air and rain descending and circulating through the soil and deep subsoil, the harvest is earlier, and the grain is better filled and more equally ripened; the roots of winter wheat are completely protected from the frost; and all these results tending to increase the crops with ease and certainty at less expense, so that subsoiling and thorough-draining form essential steps towards a truly economical system of cultivating the soil."

It may be added, that from experiment and observation the Marquess found, by his system of cultivation, the temperature of the soil was, after a while, raised two degrees in summer and nearly five degrees in winter. This alone is an immense benefit to the land, and especially in our precarious and frequently ungenial climate. It was remarked at Yester, that when part of a field was subsoiled and the other not, the furrow between the two sections marked the difference by the snow lying on the latter, whilst it disappeared after a very short time on the former. This proves the thermal difference between the two, and fully accounts for the healthy and vigorous appearance presented by wheats on land that has undergone the Yester process of cultivation.

The saving in horse-power labour amounts to one-fourth—that is, where the Marquess kept eight pairs, he now keeps only six pairs. No extraneous manure is applied to the soil, such as guano, bones, or salts; the farmyard manure alone being used on any of the farms. At the same time, the crops of all kinds have largely increased. Thus, on land which previously had produced only 29 bushels of oats per acre, although thorough-drained; when subsoil-trench-ploughed also, a crop of wheat of $38\frac{1}{2}$ bushels per acre was reaped, the weight being double that of the oat crop. On another field the crop of oats was increased from 37 to 61 bushels per acre; and so on with all the rest of the farm. The outlay, therefore, was a highly reproductive one, and forms a striking illustration of the soundness of the principle advocated, of disintegrating the soil in the act of ploughing as much as possible, instead of studiously turning it over in one unbroken and compact furrow-slice, as insisted upon by the judges in the competitive trials.

As steam culture is likely to be extended over the country more and more, I shall now refer to the effect this is likely to have on the mode of tillage. The extract I have already given from the letter of an eminent machinist, is indicative of a complete change in this respect. If the cultivator, in its operation, is found to be so superior to the plough, it must be because it more effectually disintegrates the soil, and thereby lets in the air to every particle, as far as it is cultivated, which, if desired, may reach to 18 or 20 inches, thereby stirring the subsoil as well as the upper, without turning the

latter over. I have looked over a great number of letters from persons who have purchased the steam-cultivating implements and machinery of Mr Smith of Woolston and Messrs Howard of Bedford, and who have worked their lands on the "smashing-up" system, practised and recommended by the first patentee; and without any exception, they all ascribe the uniform success attending it to the complete pulverisation of the soil, in contrast with the action of the plough in turning over without breaking the furrow-slice. So ample and decided are the testimonies to this fact, that it is impossible the plough can much longer be able to stand its ground, unless upon a new construction, similar to that of the Marquess of Tweeddale's or that of Hancock's plough. This latter is coming much into favour with the farmers, especially in the north, and is likely to be very popular; but at present its action as to depth of tilth is too limited, and it must be seconded by a subsoil plough and thorough-draining to render it perfectly effective.

One of the collateral advantages of the cultivator over the plough is the destruction of weeds, especially twitch-grass, which is brought to the surface by the tines unbroken and free from soil, unless the land is very wet. This is an important consideration in breaking up stubbles after harvest, at which time the land is frequently very foul. The common plough cannot do this, and it requires two or three operations of the harrows—once to break the furrow-slice and afterwards to collect the weeds. The cultivator, on the contrary, does it at once, bringing everything to the surface ready to be collected and burned or carted off the field. So far as my own judgment goes, there is not a single advantage attached to turning over the furrow-slice unbroken and impervious to the air with the exception of its surface. The grand object of tillage is the aëration of the soil as quickly and to as great an extent as possible. The modern ploughs protract the process by exposing only the surface to the atmosphere, leaving it to time to effect the rest.

Speedy pulverisation, deep culture, and thorough-draining, are now the distinguishing marks of good husbandry. Without the second, the first and third are only half efficient. By breaking up the subsoil you assist the action of the drains in carrying off the superabundant water, and thus, instead, admit the atmospheric air. Nature "abhors a vacuum," and in well-drained and subsoiled land, the interstices of the earth are alternately filled with rain and air. The first falls, and by its gravitation drives out the air; but the subsoil being rendered porous, it passes through it, after being divested by the earth of its fertilising elements, and is discharged through the drains, the air again taking its place; and thus, alternately the air and the rain occupy the soil and subsoil, imparting in abundance the elements of fertility.

On the other hand, most of our agricultural plants require a greater depth of earth to develop their roots, and through them

their stems and bulbs, than the six or seven inches allowed by common ploughing admits of.

"Roots," says Stephens, "in a confined space, supplied with manure, become crowded together, decline in health, and their growth is checked. The plants may still bring forward their produce to a fine degree of quality; but it will neither be so large nor so valuable as the manure bestowed and the labour spent on the soil would warrant the expectation of. Whence, then, does such an unexpected disappointment arise? From the subsoil, though thoroughly dried, *being left in a hard state*. Were it in a state of pulverisation like the surface soil, the roots, wherever stimulated by the manures, would strike down into the subsoil, and the more they were encouraged in growth, the larger they would become; their fibres would increase in numbers, and they would stretch out and reach the bottom of the pulverised subsoil; the crowding of the roots in the surface of the soil would be entirely avoided, and the loss of health and stuntedness in growth of the plant would be replaced by vigour of stem and leaves, strength of constitution, and capability to yield the largest quantity of produce." *

This quotation is truth to the letter, and as an illustration of it I give the following fact. A few years since I occupied some land in Ireland, which was bordered by a small stream, the height of the water in which, of course, formed the level of the water in the adjoining soil. On digging down to the subsoil, I always found that the roots of certain plants, when they reached the level of the water (which was also the termination of the tillage), invariably turned, and, continuing to grow, were curled in lumps as large as my fist. The subsoil was a hard clay, and the roots were not able to penetrate it. But, stimulated by the richness of the soil, the plants continued to grow, and the roots also; but having no power to enter the wet subsoil, they thus curled up in lumps as a matter of necessity. The depth at which the water level occurred was about 2 feet.

The plant in question was the common wild convolvulus, an indigenous one possessing extraordinary vigour of growth, and this will account for the manner in which the roots developed themselves, notwithstanding their inability to proceed farther downward. The principle, however, involved in the circumstance applies to all plants, although those of a more tender constitution, instead of continuing to develop their roots when stopped by the hard clay and water, would become stunted. Wheat, for instance, if the subsoil is broken, will penetrate with its taproot to the depth of 6 feet, and its stem and ear would grow in proportion; but if the root is unable to penetrate the subsoil, its growth will be stunted, and its productive powers weakened.

Although I cannot speak of any instance in which those who have adopted the steam-cultivator have wholly given up the plough, it is the opinion of some of them that eventually it will be entirely superseded by the cultivator; so satisfied are they that *stirring* the soil is quite as effectual as, if not more so than, *turning* it over—

* Stephens on Deep Land-Culture.

certainly, than turning it in the model style patronised by the judges. That this, however, will be the ultimate result, there is strong reason to believe, as well on account of the large amount of the work it will perform in a given time over the plough, with the same power, as of the more complete and more speedy pulverisation of the soil effected by it. The employment of steam as the motive power in working the cultivator has greatly increased and perfected its action, being less subject to those casualties which necessarily attend the employment of animal power.

There are other advantages attending the employment of the cultivator instead of the common plough, and the consequent breaking or "smashing up" of the soil by the first operation. One of these is the free admission, on the one hand, of the night-dews of summer (when they are most copious) into the pulverised earth, from the atmosphere; and the increased action, on the other, of the capillary attraction, by which the moisture below is drawn towards the surface, so that, in the driest weather, land that has had its soil and subsoil well comminuted will support vegetation in health and vigour, whilst that which has been tilled with the plough in the ordinary way will be burnt up. I believe it is not generally known how copious these dews are in the summer months when they are most wanted. A teacupful has been taken off a single cabbage plant at one time, besides what the leaves had imbibed and that which had trickled off to the ground. Now, on ploughed land tilled to the depth only of 6 or 7 inches, the dew cannot penetrate below the furrow, and the greater part of it rests upon the surface; so that, when the sun gets towards the meridian, it is soon evaporated and lost to vegetation. Not so on the land that has been deeply and minutely cultivated and separated. There it sinks into the soil, and displaces the atmospheric air in the same manner that a shower of rain would do, and the plants have the full benefit of it. Capillary attraction is also well known to be the power possessed by fluids of rising above their level in fine tubes or pipes, or even by a succession of interstices. Thus, if a lump of sugar is placed in a shallow dish of moisture it will soon absorb, by capillary attraction, as much of it as is sufficient to supersaturate its whole bulk. It is the same with the earth, which, if well pulverised, presents a series of interstices which act exactly as does the sugar, or a piece of sponge; and this action is accelerated by that of the roots of plants, which, penetrating the depths of the comminuted soil, powerfully help to attract the moisture from below: and thus, whilst on land cultivated in the ordinary way, and in which the roots of plants have no power to strike into the subsoil, vegetation is soon dried up, and either weakened or destroyed; on well-cultivated land, where the soil and subsoil are alike opened to the influences of the atmosphere above, and of capillary attraction beneath, there is always moisture sufficient to sustain vegetation in health and vigour, and hasten the process of florescence and fructification.

I shall close my remarks by a recapitulation of the principal points of the question. The objections to the modern plough are, that it leaves the soil in an unbroken state, unfit for a seed-bed, and requiring time, and a series of subsequent operations, to produce that object; that by merely cultivating the surface, the beneficial action of the atmosphere upon the soil is to a great extent neutralised, and the plants are subjected to the risk of drought, on the one hand, and a retention of moisture in redundancy, on the other; that without deep culture and perfect comminution, the benefits of drainage are only partially, or at least tardily, produced; whilst capillary attraction is equally interrupted, and the soil is deprived of the advantages of speedy riddance of moisture in the one case, and of a seasonable supply in the other. Unless, therefore, an alteration can be devised in the construction of the plough to meet the requirements of tillage, and to rectify its present defects, that implement will have to give way before the conviction that is rapidly forcing itself on the minds of agriculturists on the subject of tillage.

The cultivator *meets* to a great extent the requirements of tillage, and rectifies the defects of the common plough. It comminutes the subsoil to the depth of 16 inches as well as the soil, leaving them in a state to receive benefit from both aëration and capillary attraction—absorbing the dew and the rain, conveying the excess down to the drains, instead of discharging it by evaporation from the surface. It eradicates weeds by bringing them to the surface, instead of burying them, with the view of tearing them up again with the harrows; in short, it accomplishes the desired object of good husbandry, by bringing the soil in the most expeditious manner into the proper form for a seed-bed.

The Tweeddale plough, however, must be considered superior to the cultivator, and if it can be worked by steam instead of horse power, will supply every requirement of cultivation. I cannot, in fact, see why a ten or twelve horse-power engine should not be able to draw one of these ploughs (if not two) as well as the same amount of animal power. Upon this I do not assume to be at all qualified to give an opinion; and if I have ventured the above hint, it is in the hope that it may be taken up by those who better understand it. Of one thing I feel certain, that there is no operation in husbandry, however complicated or difficult, that the skill and perseverance of the British machinist will eventually fail to overcome.

On this question of comminution and deep culture, united with thorough-draining as the basis, depends the future of agriculture; and this is the view of it taken by many of the leading men of the day in that branch of industry. Nor can the question long remain either in abeyance or be rejected as visionary, for the proofs are multiplying from day to day of the benefits of the system. "One lesson, at all events," says Mr Smith, "to be learned from a review of what has been done during the last eleven years, is, that

on the deeper pulverisation of the soil, and in the finer preparation of its surface, we have the means of increasing its fertility ; and that if we have not yet a complete set of implements able fully to secure these points, we have some which, to a certain extent, meet our wants."

We conclude with "Poor Richard's" advice :—

" Plough deep while sluggards sleep,
And you shall have corn to sell and to keep."

THE DUTCH MANAGEMENT OF PEAT SOIL.

ON reading the interesting book, entitled 'The Dutch at Home,' written by M. A. Esquiros, our special attention was given to that portion of it which describes the Netherland mode of cutting "peats" with systematic economy of soil, and the details of drying them for fuel, which furnish useful hints to owners and occupiers of peat-mosses, or "bogs," in Great Britain and Ireland. The subject, though of the most dull and earthy nature, has been treated in such an agreeable and picturesque manner by the accomplished writer (whose translator leaves us no plea for dissatisfaction at our inability to read the work in its original tongue), that we can almost see beauty and poetry in the smoke which rises from the roof of a chimneyless, turf-roofed, turf-walled cabin by the side of a peat-moss—or turf-bog, as the Irish love to designate the matter in question.

With regard to the origin of peat-fields generally there has been much diversity of opinions, some of which are too absurd for any consideration. The conjecture that deposits of peat formation may have been borne from more northern lands in great deluges by the ocean to the low-lying coast of Holland, has plausibility ; but this hypothesis is inapplicable to the highlands of Great Britain and Ireland, where the same sort of substance abounds ; such theory fails altogether here. A common cause of the origin of the peat in the northern countries of Europe may be better assigned. We are satisfied with the explanation suggested by Sir Humphrey Davy, and that is in its principle identical with the observation of M. Esquiros, as he viewed a wood "in which he saw, so to speak, the peat forming under the naked eye. Half copse, half peat-bed, this melancholy wood constitutes a new genesis—the genesis of the present phenomena of creation ; the limit between a part of the vegetation which is decaying ; the passage of the living wood into the peat stage ; the phases of this more or less rapid operation ;

the labour of the slow chemical agencies by which vegetable matter is transformed into a species of growing land." In Holland there is a broadly-defined distinction between the high and the low peat-beds, as in Ireland the red spongy fibrous bog is distinguished from the compact black bog, and the modes of treating them are different. We shall give the substance of M. Esquiro's details of the *modus operandi* near the town of Assen, in the neighbourhood of which there are country villas, with gardens and grass-fields, which were but peat-beds twenty-six years ago. Nor have the peat-beds disappeared—this would be a calamity to the inhabitants, to whom this peat is permanent wealth. Many of the peat-beds are uniformly worked, and private canals intersect them for drainage, and also for the purpose of communication with a central canal which connects Assen with Meppel, on which heavy barges sail with freights of the fuel. Larger boats navigate the canals of other provinces, and even cross the Zuyder-Zee, and, like the canal-boats of China, they serve as constant habitations for the boatmen and their families. These boats are loaded with the greatest regularity of measure, and also of form, which resembles that of the angular roof of a house. Even the porters who carry away the unladen peats, like those of some of the Scotch maritime towns, are an organised class, with a commissioner and strict regulations, with certain privileges of a pleasant character; they must, however, abstain from smoking while loading or unloading the barges, and this privation is probably borne with equanimity as absolutely necessary where so much inflammable matter surrounds them. The trade in this most necessary article of consumption is very considerable, and yet increasing, being, according to the author's computation, fifty times greater than that of the coal trade. He counted seventy brick-kilns between Zwoll and Arnheim, turning out bricks by millions; and as peat fuel is used in all the factories and all private houses, the number of tons annually consumed there amounts to several millions. Like the coal-mines of Great Britain, the peat-fields of Holland are a source of employment to a large portion of labourers and tradesmen. Its much greater bulkiness, however, compared with that of coal, and the evolution of less heat, are obstacles to its employment in many instances. As among ourselves, and with equally doubtful or disappointing results as to profit, the Dutch have adopted methods for compressing peat, and for converting it into charcoal. This charcoal is universally used in winter for "feet-warmers" by females, who use them even in the large churches, though often to the injury of their complexions.

"It is the economic principle of the Dutch to utilise everything they come across; hence they have laid under contribution the ashes, soot, and smoke of peat. These ashes fertilise some lands, while other portions of the Netherlands reproach themselves with having overlooked the fertilising qualities of this manure, and abandoned to Flanders one of the richest principles of

cultivation. The soot is employed in some households to clean steel or tin instruments, while the smoke is used to prepare salt meats, and those millions of herrings which the coast fishermen draw into their nets. Peat has not only been used as a means of warming, but also lends itself to various branches of trade. The peaty substance can be applied to gas-lighting; it supplies a basis for the manufacture of paper, ink, varnish, and also animal-black (the *noir-animal* of French manufacture, we suppose), especially for the sugar-refineries. In marshy districts peat is employed in the laying of the foundations of houses. The bricks and other masonry-work are laid on a primary bed of lumps of combustible earth, arranged in the shape of a pyramid. This peat swells under water, and thus forms an invincible foundation, which the damp does not destroy. After centuries, when the house has fallen through decrepitude, the peat is found to be as good as on the first day, and still fit for firing.*

We are now approaching the more practical part of the subject, the economical and systematic manner of cutting away the peat-beds, and fertilising the subjacent soil. The first preliminary operation is to drain the spongy surface, which in the case of a semifluid flow-moss cannot always be done without the use of long wooden shoes to protect the feet of the workmen from sinking. The parallel drains are traced at equal distances of about 24 feet, and shallow in the first instance (3 to 4 feet), to allow for the gradual subsidence of the bog, which may require eight years before the cutting commences, the drains being deepened as the degree of subsidence may permit. The water is collected in trenches, kept in by sluices, and conveyed by pipes to the canal which is to bear away the manufactured peat. When the work of cutting away the peat for fuel commences, the men work in small gangs. One man cuts the surface with a sharp *stikker*, a second lifts the cut sods with a light spade, a third receives the sod from the second man, and lays it with a sort of fork in a wheelbarrow, which is rolled away by a fourth labourer to an open space, where the reeking sods are arranged neatly in the form of a wall, and this is effected by carefully upsetting the barrow in exact line, and so that the sods may be placed without being handled in their impressible state. "When the peats have acquired sufficient consistency to be handled, they are ingeniously arranged so as to be exposed on all sides to the sunbeams and the influence of the wind. The workmen form mounds, being careful to lay one sod sideways on every two sods. The field then displays symmetrical rows of squares, with small paths between them, along which the women and children employed for this work walk. When the top sods begin to dry, they are placed at the bottom, the others raised. We have seen the hopes of an abundant harvest destroyed by continued rain. The west of Ireland can testify to the occurrence of such a calamity there. The forming into small mounds, and afterwards stacking and covering with thatch the dried

* 'The Dutch at Home.' By Alphonse Esquiros, Author of 'The English at Home,' &c. Translated and edited by Lascelles Wrixall. Vol. i. p. 154. London: Chapman & Hall.

peats, does not differ from our ordinary process ; but we are further informed that the Dutch sometimes place the peats in sheds on laths or planks, so laid that the wind can freely circulate through them." The peat does not leave these sheds till it is transferred to the long barges that carry it to market. We would suggest the use of movable sheds, for which, the thinnings of plantations would afford cheap and ready material, with shingle roofing, or a thatch roofing of heath or rushes. On a large systematic and commercial scale of turf-cutting operations, which, in many localities of the interior of Ireland especially, might be advantageously pursued in favourable seasons in anticipation of unfavourable ones, sheds of light iron framework with tarred canvass roof might be constructed for drying the peats on barred shelves at each side. Being thoroughly ventilated, the peats would dry rapidly, and give place to others to be dried, and then stacked in places easily accessible to boats or carts for removal to town or village depots, or for sale on the spot in the early autumn. The hardships of the labourers, male and female, employed in the several operations of turf-making in the showery months of April and May, are frequently severe, and productive of maladies. Drying-houses, therefore, would be of great relief to them during rainy periods ; a curtain of any rude material—even matting—closed at the weather side, would serve to them as a covert from the transitory storm, and the peats would be in progress of drying in their triple or quadruple tiers of open ranks and files, with free passage for the air around and between them. A frame of this nature might stand on the same spot for some consecutive years, until a considerable area of bog should be entirely cut out. Philanthropy suggests a contrivance of this sort, and financial economy would not, we believe, act in antagonism under right management. The price of turf in the Irish towns dependent on this fuel is usually high in winter (relatively with the price of coals in general), and sometimes, as in the last year, dreadfully dear, and in many localities coals are hardly accessible. Systematic arrangement, therefore, for turf-saving on a large and comprehensive scale, would be a great boon to the inhabitants of many parts of Ireland and Scotland : a favourable year ought to be turned to profit against years of rain and consequent scarcity of peat-fuel. Peat-cutting, in the Dutch system of regular, even, and complete excision, ought to be viewed as an important branch of the farmer's (and landowner's) occupation in all our bog districts.

In olden times the Dutch cut away but barren peat-soils, but when the great profits produced by the peat trade became apparent, they began to cut away even fertile fields. "Holland offered the astounding spectacle of a people enjoying a very limited territory, and yet incessantly working at its destruction. The finest fields man's eyes had ever surveyed disappeared, and the Government of the country thought itself bound to set limits to this devastation

of the earth. Henceforth no one was allowed to dig up his field, save under certain conditions, and not till he had obtained the consent of the magistrates." For an onslaught on such "low peat-bed" there is still the necessity for previously obtaining such permission, and the work is then proceeded with in the usual style of marking out parallel strips for the demands of consecutive years. The surface arable earth is first removed to another part of the field, to be replaced over the area of the field when the peat has been taken away, as the basis of fresh cultivation. The beat below is generally so saturated with water, that the workman who spades up and throws the sods into a barge alongside wears waterproof boots. This wet, brown-coloured peat, which is mixed with much woody fibre, is landed from the boat; it is discharged into a wooden trough, about 12 feet in circumference and 2 feet in depth, in which it is worked by the feet of a labourer, who also clears away any roots or stones that may be in the sods. Four or five hours are allowed to elapse before proceeding to level and mould this liquid peat. When it is sufficiently dry, a workman fastens a little plank to each foot, and, thus equipped, treads down the soft matter, whose surface soon becomes smooth. This task is fatiguing. When the peat has been thus worked up, it is again left to dry; then with an instrument resembling a rake lines are drawn indicating the future form of the slabs, and the bed then presents the appearance of a chess-board. Another workman with a spade, which he inserts vertically, cuts out the peats. A sheet of water soon appears in place of the verdant field; but in many instances ponds so produced have been stocked with fish; in other cases they have been drained, and, by the help of mills which lift the water into aqueducts, and the protection of strong dykes to keep out external waters, promptly dried up, and the rich clay substratum converted into a source of fertility. Many pecuniary losses, however, have been sustained by speculating improvers in such works; and even now, after success has been attained, the cost and maintenance of mills, &c., to remove internal, and resist the influx of external waters, by dykes is considerable, and causes "the prices of cereals and other products of the land to be relatively high. There is also another source of danger; the low soil of the Netherlands is daily rendered lower still by the works carried on in the peat-beds; and if the sturdy dykes built against the high tides were to give way, and the sea seize on these farms, situated several feet below its level, the disaster would be terrible and irreparable. It would require years and prodigious efforts to restore to light these swallowed-up fields." The late influx of the sea waters on the Lincolnshire fens, by the failure of dyke embankment, has been a memorable and calamitous illustration of the difficulties and dangers to which the Netherlands have been and always will be liable. By a perversity of human nature, and inattention to the value of benefits which Providence places

within our easy reach, tens of thousands of easily-dried peat-fields in Ireland, with fertile *substrata* of calcareous earth near the peat-service, and perfectly protected from external inundations, are lying unproductive, under a coverlid of peat, which, if removed, would serve to warm a multitude of human families, heat limekilns, and serve other useful purposes, and expose the body of soil underneath to the stimulating influences of light and heat; and ordinary arterial drainage judiciously conducted would, in nine cases out of ten, obviate the necessity of artificial aqueducts elevated above the drained surface, with mills to pump up the waters of the lower lands.

Generally speaking, the most miserable hovels and the poorest and most naked and ignorant of the Celtic peasantry of the United Kingdom are located on the margins of extensive peat-bogs, which have usually supplied them with potatoes and fuel; and the uneven surface of the peat-fields in which they have so irregularly wrought, with pools of stagnant water attesting the wasteful mismanagement of it, would strike a thrifty methodical Hollander with amazement. Viewing the cabins and the condition of the soil around them—as it may even at this day be seen—in our country, he would read, with national pride and pleasure, the following remarks of M. Esquiroz on the past and present conditions of some peat land near Groningen, which in 1628 was disposed of in lots to colonists:—

“At the beginning, poor cottages were built in these barren fields, and soon the extraction of the peat commenced on a grand scale. Peat incessantly diffused more and more wealth through this remote country of the United Provinces, and handsome country-houses took the place of cabins and marshes. Each peat-bed, so soon as exhausted, was converted into arable land, which was first covered with oats, rye, and buckwheat, and eventually with potatoes. The buildings and clearings continually progressed, though not without meeting obstacles; and the works were several times suspended. But after each enforced repose, the colonists said, ‘We will begin again,’ and they continued to restore life to this uncultivated soil. . . . When we calculate the amount of obstacles they had to overcome, we experience a feeling of thoughtful admiration for these ancestors. . . . A flourishing population, a continued circulation of boats and waggons, a wealth elsewhere unknown of buildings and pleasure-houses, which rise at a spot where there were once only stagnant waters and a desolate hearth—all this forms a monument erected to the glory of human perseverance.”

No physical or mechanical difficulties are opposed to a regular and systematic removal of the surface of the Irish and Scotch “bogs” (let us use the Hibernian designation here to propitiate our friends in the Emerald Isle), at elevations much above the level of lakes, streams, or canals, so that the subjacent soil may be commingled with the *residuum* of the abraded peat, and perfectly drained and levelled. Nothing more is necessary than the clearing away of the substance which it is the object to convert into fuel;

yet a stupid indifference has long prevailed with regard to the prospective benefits which would accrue from a right method of executing the work. Some of the recent agricultural Scotch settlers in Connaught have set an example of correct management in this respect, as we have stated in a former number, and acquired productive land, instead of an encumbering and useless mass of moss and heath : this has been done by a few skilful farmers, whose operations will probably have extensive influence. Where commercial speculation has been combined with agricultural skill, great results have followed. The writer of the present article, about thirty years ago, noticed in this 'Journal' * the great operations of Messrs Steele and Brown, under the guidance of a Scotch manager of much ability and zeal. We give here an abstract of that report :—

"These gentlemen employed in one year, during the turf-cutting season, 380 men, 20 women, 84 able boys, and 120 young boys. As the work-people cut away the peat, the manager had the exposed surface levelled, and laid down with oats and grass-seeds. The entire bog of 184 acres is divided into rectangular subdivisions of about 6 acres each ; and some of these, by their verdant appearance, are ornamental to the house and productive garden occupied by the superintendent. The house, built on the argillaceous subsoil nearly 20 feet below the original surface, was hardly visible at first from the river Shannon until the surrounding peat was cut away. Four or five years afterwards the garden was surrounded by a high and close-set thorn hedge, and contained, besides all kitchen vegetables, some choice American flowers, many of them the usual occupants of a greenhouse, but here flourishing in their congenial peat-soil."

Unhappily, this example has not been followed as it might have been. The period, perhaps, is not distant when some adequate provision for drying peats to a certainty, and preserving the manipulators of them from the effects of rain, may be effectively contrived, and widely adopted, by energetic men possessing the long-desired and greatly-needed requisites—capital, and a spirit of judicious enterprise.

D.

* No. 31. Dec. 1835.

THE NATURAL LAWS OF HUSBANDRY.*

THE celebrated author of this work adopts in it a style which was much in vogue in this country many years ago, when it was usual to hawk through the town and countryside where any one has been hanged, a publication bearing the title of "The last speech and dying declaration of such a one." He is indignant that his views are not embraced with that cordiality and public gratitude which they appear to him to deserve. And he remonstrates in a melancholy tone with all agriculturists, nay, with all patriots, for their backwardness in accepting them. Not that he despairs as to the ultimate result:—

"I build my hopes," says he, "however, on the young generation, who enter upon practice with a different preparation from their fathers. As for myself, I have reached the age when the elements of the mortal body betray a certain tendency to commence a new circle of action—when we begin to think about putting our house in order, and must defer to no later period what we have still to say.

"As every investigation in agriculture requires a year before we have all the facts before us, I have scarcely any prospect of living to see the results of my teaching. The only thing that remains for me to do under these circumstances is to place my views in such a manner before the public, that there can be no possibility of misconception on the part of those who will give themselves the trouble of becoming thoroughly acquainted with them."
—(Preface, p. 13.)

It is indeed very vexing to a deeply-convinced and enlightened man who has a great thought to communicate when nobody will listen to it so as to take it in. And the case of the Baron von Liebig is in some respects more trying than that of most discoverers in science. The law of applause was reversed in the case of the German chemist. That law is to the effect that the discoverer shall not be disturbed by the intrusion of an admiring world till he has done all he can for the cause of truth. But Liebig's fine social temperament, combined with his high scientific culture, enabled him to popularise his views as fast as he formed them, and to surround himself early in life with a circle of young disciples, gathered from all nations, who diffused them as fast. And the consequence was that, before he had arrived at middle age, he stood among the top chemists of the world. But of late years his fame has been undergoing a process of emaciation. His views, which had been a first love with many, have not been able to hold their place. And perhaps it may be said that the present tendency is to undervalue them, as much as twenty years ago it was to overrate them. This must be very trying to one who has shown that he is by no means

* 'The Natural Laws of Husbandry.' By Justus von Liebig. Edited by John Blyth, M.D., Professor of Chemistry in Queen's College, Cork. London: Walton & Maberly.

deficient in that irritability which is said to be the characteristic of genius ; and it fully explains the tone of the present publication. This alternation between applause and disparagement is, however, the ordinary course of criticism. And so far as the progress of truth is concerned, it is not to be regretted ; for in the ordinary course of thought it is only by swinging from one extreme view to another—only by a series of oscillations on opposite sides of it—that the truth is reached at last.

The charm in Liebig's views which secured for them such immediate popularity was their freshness and their simplicity. His distribution, for instance, of all the manifold kinds of foods, both of man and beast, into two great classes, the respiratory or heat-producing and the plastic or flesh-and-blood-making, and his affirmation that to the former class belong all kinds of food which are merely ternary combinations of oxygen, hydrogen, and carbon, or binary combinations of hydrogen or carbon only, while to the latter belong those into which nitrogen also enters largely, is a most captivating generalisation. And when to this there was added the doctrine that all that an animal does or can do is merely to digest and distribute in its own organisation the very molecules which the vegetable world does and must supply if the animal is to be fed, agriculture was raised to the highest possible dignity and importance, and the whole subject of physiology seemed to be beautifully contained in a nut-shell, so that anybody might put himself up to its most important facts in a forenoon, and not be much exhausted after all.

But after having had time to consider calmly these brilliant theories, the scientific world has again fallen away from them to an extent that could scarcely have been anticipated twenty years ago.

And, indeed, it is not difficult to perceive that the idea of nature is grander than that with which the philosopher of Munich credits her. He will have it that the great bulk of our food, including all sweets, oils, and fats, nay all kinds of meal and flour, except the small percentage of plastic elements which they contain, are good only for producing animal heat, and are, in fact, breathed away as common vapour and carbonic acid day by day almost as fast as they are eaten. Now this cannot surely be an adequate account of the matter. It is possible that, in the present condition of the world, a temperature considerably higher than the ambient medium may be indispensable to full organic development and life ; and it is certain that the atmospherical orders of animals, man, mammalia, and birds, organised as they actually are, must have this high temperature, else they would soon become extinct all the world over, except, perhaps, in a narrow zone around the equator. But whether there might not possibly exist in a cold-blooded animal all physical and psychological powers as well as in a warm-blooded animal, had the

Creator so willed, is by no means settled. A mighty host of terrestrial species, from the crocodile to the bee, affirm that for muscular force and exquisite instinct the world itself is warm enough without the necessity of eating so much fuel for fire within.

And, indeed, is it not obvious that we need the kind of food which our author designates "respiratory" for quite another purpose than merely to keep us warm, and for quite another destiny than merely to be breathed away again? Thus it is agreed by all that this kind of food may be characteristically regarded as hydrocarbon either immediately or ultimately, that is, as of the nature of fat or oil. Now, is fat of no use but to supply animal heat, as the school of Liebig maintain? Why, what is the nervous system composed of? what kind of matter do the brain and the nerves require in order to their development and repair—the brain and nerves on which the centre vitality of the animal depends? It will not be denied that what they require is a supply of matter as nearly as possible similar to what they consist of already. Now, abstracting the water and albumenoid matter, of which the brain and nerves in part consist in common with all the other organs of the body, this, the most important part of our organisation, consists mainly of fatty matter. And plainly, sugars and farinaceous matters and oil and fat are valuable as food, not merely for the sake of animal heat, but because they are the proper aliment and material for the construction of the nervous system. And vegetable nature produces these principles in abundance, as being part of that grand unity which all nature is, and as a preparation for the animal kingdom which is to be reared upon the vegetable.

The so-called respiratory food, therefore, is of the highest value to every animal, quite independently of the hotness or coldness of that animal's blood. Instead of being merely eaten and then breathed away, it goes into the animal tissue—the most important tissue in the animal frame, the neurocerebral tissue, just as the so-called plastic food goes into the muscular and other tissues. Nor is it rejected from the system till after the usual course of giving its force to the animal frame and then undergoing transformation. That it is breathed away and does not accumulate in the organisation in offensive forms, is indeed its privilege, answerable to its high calling as the food of the organ of the mind. But that it should be represented as food for the lungs merely, and good for nothing else but to produce animal heat, which is in many cases an evil as well as a good, is to take a very limited view of its place in the economy of nature.

Nor have we said all that ought to be said in favour of saccharine and farinaceous and oleaginous matter as food. There can be no doubt that the overplus of fat in the living animal which is not immediately required for the growth and repair of brain and nerve, and from which the nervous system can draw material as

it requires it, serves also an important purpose in helping forward the molecular architecture of the whole body. Call its action catalytic, or by any other name, it is certain that no organ grows in a healthy manner, or exists in a state of healthy activity, unless it be duly lubricated, pillowed, and interwoven with fat. On this subject, therefore, the enlightened agriculturist may safely retain those ideas in favour of fattening which, indeed, come naturally to everybody. He may rest assured that in feeding his stock so as to round their forms he is doing something more, both for man and beast, than merely providing for animal heat; and that, let the temperature of his farm or of his cattle-houses be what they may, it will not do to starve stock in its calf-skin, or feed only with a measured regard to respiratory food.

A greater discovery of Liebig was to the effect that there exist in plants, especially those which have been found to be most valuable as food, certain principles which, so far as the most advanced chemistry can discover, are identical in composition with those which constitute the blood and flesh of animals. This was indeed a very fine discovery, but the inference which naturally attached to it is not so trustworthy. That inference was, that various kinds of food are valuable as such precisely in proportion to the quantity of these plastic or flesh-and-blood elements which they contain — a doctrine which can by no means be taken for granted. And when to this it was added, that the animal organisation does not possess any power at all of forming these plastic elements out of other food, even in the smallest quantities, but can only accept, appropriate, and assimilate these plastic molecules when supplied from without, a very bold affirmation was made, which, if it be not sound, cannot but affect injuriously the whole theory of dietetics and medicine. Now this doctrine our author stoutly maintains, and along with him it still has many advocates. In our own country, indeed, the views of Dr Prout, one of the most philosophical chemists that ever lived, have formed a barrier to its unlimited acceptance. The Doctor was indeed falling into years when Liebig was in the ascendant, but he repudiated very energetically the new doctrine of the Giessen school, and maintained to the last that the animal organisation had the power, to a limited extent, of constructing flesh and blood out of saccharine, or other non-nitrogenous matter, by the aid of nitrogen or ammonia existing in the organisation. And we cannot help thinking that the balance of evidence is in favour of Dr Prout's view; while yet, on the side of our author, it remains true, that if we are not to distress an animal, and tax its powers to the utmost and to its great injury, we must supply it with an adequate quantity of plastic food, either directly from the vegetable kingdom, or from the flesh of animals which have fed on vegetables, and appropriated and made to be a part of themselves these plastic vegetable elements. That dogs, if fed solely upon sugar, or rats solely upon

starch, will become sadly emaciated, and die in five or six weeks, has been fully ascertained; but this proves nothing absolutely as to the question at issue; while, on the other hand, when looking to the animal creation in its whole extent and spontaneous manifestation, many creatures are to be found which seem secure of life and development, while yet the food they chose for themselves, so far as can be discovered, contains no appreciable quantity of plastic matter. There can be no doubt, however, that the practice in feeding must be to supply the plastic elements in due proportion, if the animal is to be maintained in health and good condition; and this fact takes from the theory of our author any evil that may attach to it as an exaggerated or extreme view.

And this is all the more important in reference to the volume now under review; for this is its central idea—that just like the animal, so the vegetable also must be supplied with every article that enters into its composition, and that as nearly as possible in the very form in which that article is found in the composition of that vegetable. And as to its practical results, his entire theory may be thus expressed:—*You must carry nothing off your field in your crop that you do not bring back to your field again, else your crops will by-and-by cease to be remunerative, your husbandry will fail, and your children's children will perish.* The characteristic, however, of his views is the place which he assigns to the ash-constituents of the crop. In other quarters the belief is that, as the bulk of the crop consists of combustible matter, of which carbon is the chief constituent, always accompanied by a proportion of nitrogen as well as of water, and its elements oxygen and hydrogen, it is the supply of carbonic acid and ammonia, or nitric acid, and therefore of decaying organic matter in the soil, which ought to form the chief concern of the agriculturist. Our author maintains, on the contrary, that these articles call for no solicitude—that by the spontaneous fixation of the atmospherical elements which are always rolling over every field, carbon and nitrogen tend everywhere to increase in the soil, however heavy the crops which are carried off, and that it is the mineral—the ash-constituents of the crop—of which it is so difficult to maintain an adequate supply, since they are absolutely indispensable to the growth of the crop and form its true food, while yet they are recklessly carried off the farm and never restored to it. And here it may be said that our author's chief merit lies—namely, in insisting that the mineral constituents of plants are integrant elements of the structure of vegetables. Previously to his day the ash-constituents were regarded as little better than merely incidental ingredients, almost impurities, accidentally absorbed. So far is that from being really the case, however, that in point of fact potash, magnesia, phosphoric acid, &c., are undoubtedly just as indispensable to the growth, the development, and the maturation of plants, as carbon or nitrogen. But this is all: they are not the only articles

which are indispensable ; they are not all nor the only food of plants—they are but one of two kinds of food, both of which are equally indispensable. And of this our author and his school require to be reminded. Not that they dispute it, but they forget it, and urge a one-sided view.

The vegetable covering of our planet is in fact the medium by which the subtle air and the solid earth are joined together in amity. It is the apparatus by which the all-pervading, the cosmical law of continuity, is established and maintained, and elements which seem at first sight hopelessly dissimilar are beautifully interwoven. The general determination of adjacent media, when they are dissimilar to each other and their particles are movable, to diffuse into each other and interpenetrate, is one of the most interesting and best ascertained facts in science ; and nowhere is it more eminently illustrated than in the relations of the atmosphere with the solid ground that underlies it. Thus the dry air penetrates the soil of the dry land and the water of the ocean, and remains permanently concealed in these dense media in large quantities. The vapour of the atmosphere is now descending as rain or snow and mingling with the solid ground beneath, now ascending again as vapour, and thus constantly weaving between the two, and by its own twofold transformation declaring that the *aëriform* and the dense are not irreconcilable. The earth again, as often as it is dry enough, is ever rising in clouds of dust and settling upon the foliage of trees, window-sills, and roofs—is ever doing what it can to carry itself up into the air ; while every cavity tends to become drusy with crystals shooting into the air which fills it, ice to form into hoar-frost, and every damp wall and cavern to effloresce with salts. Now, all these phenomena are anticipations of the vegetable kingdom, by which this grand law is most beautifully fulfilled. And hence the character of the forms of plants—they are the solid, the dense, dividing and dividing itself more and more, and becoming more and more mobile and bright—in a word, they are the solid and dense emulating the *aëriform* as far as circumstances will permit. And hence the material of which they consist—they consist of air become concrete, and earthy matter become as far as possible *aërial*. And hence their combustibility—that is, their power of rendering up as air again what they obtained from the air ; and hence their ash-constituents also—that is, their power of giving back to the earth again the mineral particles which they derived from it. Nor does this view of the nature of the plant explain their forms and their composition only—it explains the distribution in the plant-form of the combustible and the mineral constituents respectively. Thus, from this view it follows that the *aërial*, the combustible material of the plant, that which the atmosphere above supplies, shall seek down in the plant as deep as possible, and tend to concentrate itself in roots ; while

the earthy part, that which the soil supplies, shall seek up as high as possible, and tend to diffuse itself in a lace-work, aiming at the spherical, like the atmosphere and the particles of air themselves. Now, this is the distribution which has been actually ascertained. The root contains less ash than the above-ground part of the plant, the stems less than the foliage, and the foliage less than the fruits and seeds, which are the highest and last of all. And hence, according to our author, the great injury that is inflicted upon the soil, though nothing but the corn merely, or seed, be carried away from it. The corn and seed contain the most of those ash-constituents which cannot be dispensed with. And hence another practical inference (which our author's theory does not include), namely, that it is of immense importance, especially to a cereal crop, that it should not have exhausted the assimilable ash-constituents in the soil in which it grows before the time of maturing its seeds, but that it should have at that season especially an abundant supply of them.

Now, to this view of plant-life and structure this principle attaches as the corresponding principle in vegetable physiology, that the atmospherical and the mineral constituents of the plant are the complements of each other, and each is the proper stimulus for the other. When food for developing the combustible or atmospherical part is supplied in rich abundance, the roots will grow rapidly, the mineral food will rush up into the tissue, and overcome more difficulties to secure a place in it than if the supply of atmospherical food were scant; and, reciprocally, if the mineral food exist around the roots in rich abundance, it will stimulate the plant to a more vigorous assimilation of such atmospherical food as is accessible to it. The agriculturist, therefore, ought to have an equal eye to both kinds of food, and see to his field in reference to its supply of carbonic acid, water, and nitrogen, whether as ammonia or nitric acid, no less than he should see to its supply of potash, magnesia, phosphoric silica, acids, &c. Our author advocates the cause of the latter only, and here he is very strong. He has left not a stone unturned to impress, both upon the scientific and the practical man, the necessity of looking to the mineral state of the soil. He maintains that, if we are to have consecutive crops, nothing is to be trusted to nature as to replacing in the soil (by disintegration and decomposition) the ash-constituents which have been carried off in the crop; nay, that husbandry cannot do it, and that positively, in order to permanent fertility, there is nothing for it but to bring back to the field everything that is carried off. He puts his view very forcibly in the following passage:—

"In the produce of his field the farmer actually sells his land; he sells in his crops certain elements of the atmosphere which come of themselves to his soil, and with them certain constituents of the ground which are his property, and which have served to form out of the atmospherical elements

the body of the plant, being themselves component parts of that body. In alienating the crops of his field he robs the land of the conditions required for their reproduction. Such a system of husbandry may properly be called a system of spoliation.

"The constituents of the soil are the farmer's capital; the atmospheric nutritive substances are the interest of his capital; with the former he produces the latter. In selling the produce he alienates part of his capital and the interest; in restoring the constituents of the soil to the ground, he retains his capital."

And again,—

"That farmyard manure will completely restore the fertility of a field exhausted by cultivation, is a fact fully established by the experience of a thousand years.

"Farmyard manure supplies to the field a certain quantity of organic—i. e., combustible—substances, together with the ash-constituents of the food consumed. We must now consider what part is taken in the restoration of fertility by the combustible and incombustible constituents of the manure.

"The most superficial examination of a cultivated field shows that all the combustible constituents of the plants grown upon it are derived from the air and not from the soil. If the carbon even of a portion of the vegetable matter in the crop were derived from the soil, it is quite clear that, if the ground contained a certain amount of carbon before the harvest, this amount must be smaller after every harvest. A soil deficient in organic matter must be less productive than a soil abounding in it.

"Now, experience proves that a field in constant cultivation does not therefore become poorer in organic or combustible substances. The soil of a meadow, which in ten years has yielded a thousand hundredweight of hay per hectare, is found to be, at the end of those ten years, not poorer in organic substances but richer than before.

"A clover-field, after a crop, retains in the roots left in the ground more organic substances, more nitrogen, than it originally possessed; yet, after a number of years, it becomes unproductive for clover, and no longer gives remunerative returns of that crop.

"A field of wheat or potatoes is not poorer in organic substances after harvest than before. As a general rule, cultivation increases the store of combustible constituents in the ground, while its fertility, however, steadily diminishes. After a consecutive series of remunerative crops of corn, turnips, and clover, these plants will thrive no longer in the same field.

"The action of farmyard manure most undoubtedly depends upon the incombustible ash-constituents of the plants which it contains.

"In farmyard manure the field actually receives a certain quantity of all the mineral ingredients which have been removed in the crops. The decline of fertility was in proportion to the removal of mineral constituents; the renewal of productiveness is in proportion to their restoration."

In keeping with this theory he ascribes the transitory and short-lived character of the Western nations to their failure to fulfil this condition; while, with regard to Eastern nations, such as the Chinese and Japanese, he ascribes their longevity to their rigorous fulfilment of it. In confirmation of this view he gives, in an Appendix, an extract from the 'Report to the Minister of Agriculture at Berlin, on Japanese Husbandry,' by Dr H. Maron, Member of the Prussian East Asiatic Expedition, and this is not uninteresting to ourselves as a nation. Thus there is this of agreement between the Japanese

Empire and the United Kingdom, that their extent is about the same. The number of the population is in favour of Japan. The country is so hilly that not more than half its area is capable of tillage, and yet Japan produces ample food for all its population. Nay, since its ports have been opened to foreign commerce, it exports no inconsiderable quantities. Might we not, then, render ourselves independent of supplies of foreign corn also? This is the natural and very interesting question which the statistics of Japan suggest, and it follows from our author's theory that we might do so if we adopted the Japanese system of agriculture. Now, the single principle of that system is to return to the soil, in the form of manure, all the fixed principles that are carried off in the crops. In Japan, moreover, the practice of this theory is reduced to its terms of utmost simplicity; for, as the religion of the Japanese forbids them to eat flesh, they keep no cattle. Man is the only manure-producer. But for the sake of conserving to the utmost, and returning to the fields everything of this kind, all possible care is taken. The Japanese practices in this respect, however, are confessedly such as European civilisation could not brook. And even granting that this is the only condition of permanent fertility, it is admitted that the question of deodorising and removing the offensive properties of such manure remains as a problem that must be solved before the practice of agriculture, even according to this view of it, is placed on a right footing. On this subject it is to be regretted that our author, after having ventured to encounter it, says so little. He gives but one short chapter on Poudrette. It contains some statistics of much interest, as also the fact that the deodorising of pits and cesspools by means of sulphate of iron does in no degree impair the value of the manure, but he scarcely touches on the great sewerage question. He details, however, the arrangements in certain garrisons in Germany, and adds,—

“The peasants about Rastadt and the other garrison towns, having found out at last, by experience, the powerful fertilising effect of these excrements upon their fields, now pay for every full cask a certain sum (still rising in price every year), which not only has long since repaid the original outlay, besides covering the annual cost of maintenance, repairs, &c., but actually leaves a handsome profit to the department.

“The results brought about in these districts are highly interesting. Sandy wastes, more particularly in the vicinity of Rastadt and Carlsruhe, have been turned into smiling corn-fields of great fertility.”

These facts are very valuable, as every statement is which tends to forward the right solution of this great though disagreeable inquiry. Surely it is not beyond the powers of European chemists and inquirers, if they would lay their heads together, to accomplish, without offence to the senses, those ends which the Japanese have shown to be so important. Nor is this the only good end which would be secured if the problem could be thoroughly and practically

solved. It is certain that the very same stuff which, when conveyed from the town and distributed over the fields whence it came in the shape of corn and meat, imparts to these fields, without further trouble, a permanent fertility, fills the town wherein it stagnates with the seeds of disease. It may be true that certain forms of fever are propagated only by contagion, but it is more certain that other forms of fever, and many diseases besides, are produced by miasmata, of which our towns might be cleared by adequate sewerage. In fact, there is a loud call at both ends of the road, both in the town and in the country, for great efforts in this department. Success will have a twofold reward — better health for townspeople, and cheaper food for their better appetites.

We cannot help hoping, however, if not even thinking, that the conditions of permanent fertility are not altogether so inexorable as our author maintains that they are. It is not denied that in every field, however long it may have borne crops, there still remains enough of potass, magnesia, silica, phosphoric acid, &c., for as many crops again. It is only affirmed that these mineral constituents naturally exist in such a state of chemical combination that they cannot enter into a plant. To explain this difference of state (of which there is no doubt) our author designates the one, that which is useful for the crop, a state of physical combination; the other, a state of chemical combination. And, perhaps, in the actual state of science, no better names can be found. The simple fact appears to be, that a good open soil has the power of arresting and associating with itself such chemical particles held in solution in the water that percolates through that soil as are fit for the food of plants, and that until these chemical particles be thus arrested in the water in which they were previously dissolved, and presented to the roots of the plant by the soil with which they are now united, they are not assimilable by the plant, at least so as to give a crop. It is a very fine discovery of late years, to which our author gives due prominence in his volume, and to which he has himself contributed, that even water from a dunghill, if it pass through a portion of open soil not already saturated with such particles as it holds in solution, will come away quite pure, leaving behind it in the soil all its mineral and vegetable impregnations as far as they are of use for the growth of crops. Now, it will be admitted that all that is required in order to the fertility of a field is, that the plant food-particles of all kinds existing in it shall pass over, in sufficient quantity for the crop, from their states of combination as known to the mineralogist and chemist, into this state of so-called physical combination with the soil. And are we to take for granted that such a transformation of their condition is altogether impracticable by art? It is not denied that nature accomplishes it, and that tillage can assist her; only it is affirmed that here her action is so slow that all our population would die down to their last remains if

things were left to the course of nature, while corn was annually carried off the fields and not an equal return made. But if nature accomplishes it at all—if sunshine, rain, frost, exposure to the atmosphere, eremacauses, nitrification, &c., do develop plant-food out of the previously unassimilable particles of the soil—may we not hope in this, as in so many other cases, that art may come in to second the operation of nature, and restore the mineral condition of the soil which is necessary to the growth of a crop on some less onerous terms than long and often-repeated fallowing, and the bringing back, particle for particle, all potass, magnesia, silica, phosphoric and sulphuric acids, which we have carried away? In the mean time, and provisionally until a method of doing so is discovered, no doubt the safe course is to restore whatever has been carried off, if the produce will cover the cost. But if this be, as we trust it is, only a provisional law, does not a theory of agriculture which maintains that this is “the natural law of husbandry,” go too far? for it discourages experiments as to the intimate amelioration of soils in respect of their own contents. It discourages experiments to bring over by various appliances the mineral constituents of plants from a state of chemical combination with one another to that state of physical combination with the soil in which plants can feed upon them.

According to the view which has been given above of the position of the vegetable kingdom in the economy of nature, we should expect that, as on the one hand an abundance of mineral plant-food, in a state fit for immediate use in any field, reacts powerfully in fixing atmospherical plant-food, carbon, ammonia, water, and its elements, in the tissue of the growing crop; so, reciprocally, an abundant supply of carbon, ammonia, &c., introduced into the soil, should react powerfully in relieving from its state of chemical combination the mineral plant-food in that soil, and in bringing it into the state in which it could assist in the growth of the crop. And, indeed, is it not evident that the spongeoles of the rootlets possess such a power? Even without the use of the microscope one may see that a rootlet, in travelling over a limestone, engraves its course on the stone, thus obviously dissolving it; and who will deny that what happens to limestone may happen to other kinds of stone and mineral grains in the soil? Chemistry is in no condition to affirm that the spongeole of a living plant cannot possibly liberate potass, or phosphoric or silicic acid, from the mineral engagements in which it finds them; and there is nothing to oblige us to despair of ever being able to assist the plant in doing so. Meantime let it be granted that the safe course to permanent fertility is, as our author contends, the restoration to the soil of all the mineral particles that have been carried off from it.

To this doctrine our author attaches certain corollaries which are both curious and interesting. It is, for instance, a fact, which every one perceives in a moment, that the strength of a chain, how-

ever long, is determined by the strength of its weakest link : and similarly, our author maintains that the productiveness of a field is determined by that element of plant-food which exists in minimum quantity. Suppose, for instance, that in a field where oats or potatoes are to be grown, there is only available potash sufficient for a light crop, he maintains that nothing would be gained to the crop by manuring to any extent with phosphoric, or nitrogenous, or all the otherwise most valuable manures, if they did not bring also an additional supply of potash. And similarly, a wheat-field might be manured to the highest degree, and yet the crop fail, if there were not present a supply of assimilable silica. This is a very important view, if it be sound ; and, in the mean time, it certainly enables the author to explain the failure of many experiments where high manuring was ineffectual in giving satisfactory returns. And hence the value of highly-compound manures, such as that of the farm-yard, which bring back to the soil more or less of all that has been taken from it, more or less of all the ingredients which form the food of crops. There is nothing, except the Japanese article, which, in the opinion of our author, can compete in point of value with farmyard manure. He devotes a chapter to guano, and shows how handy it is, and how rich in phosphates and nitrogen, of which 1 lb. contains as much as 50 lb. of farmyard manure. But still, in consequence of its deficiency in potash, it cannot prevent sterility at last. Much of its value depends on the facility with which it may be manipulated and distributed in the neighbourhood of the roots that are to feed upon it.

In this last remark there is a reference to a doctrine which is but recently established, and which places the present volume not a little in contrast with Liebig's earlier works. We mean the discovery that the food of plants at the time of absorption is not in a state of solution in water as was previously supposed, but in union with the soil (as has been already stated) to which the water has previously given it up. From this it follows that almost the entire economy of the plant, and its telling upon the soil, depends on its root. Formerly, when it was believed that the food was brought to the root by the water that was percolating and passing through the soil, all that seemed requisite in an adequate root was a sufficiency of spongeoles or absorptive points. But now that it is found that the fibres of the roots must go in search of food if they are to get it, many important consequences to agriculture follow which were not apprehended before. Hence, for instance, the necessity of as uniform a distribution as possible of manure in the region where the roots of the plants are to travel. Hence, also, the necessity of a special inspection of the roots of plants, with a view to determine those which should succeed each other in a rotation.

And in this connection one of our author's most beautiful investigations presents itself ; inasmuch as all the fodder plants, all green

crops agree in this, that their roots are deep-searching, compared with those of the cereals: they draw from the subsoil, while the cereals draw from the surface soil. And hence the reason why these two kinds of crops do not interfere with each other, nay, why a green crop, if eaten off or ploughed in, may pave the way for a productive cereal crop. It brings up from the subsoil the mineral food which the cereal roots could not otherwise have reached. And thus a green crop is equivalent to a manuring of the surface. But here our author does not forget his great theme of ultimate exhaustion. What the subsoil imparts to the surface soil, it has given from its own bosom. The field, as a whole, is all the poorer for the green crop that has been raised on it. And what has been fully done once cannot be done again. And this, as he states well, is all the more needful to be considered, because it is so difficult to reach the subsoil so as to enrich it again by manure. For, let the surface-water of the soil be ever so rich in the food of plants, that food is all detained at the surface in physical combination with the soil there. The water itself may, and no doubt will, percolate to the subsoil; but before it has reached it, that water is perfectly pure. It contributes nothing to the subsoil but itself, and this, generally speaking, is no acquisition in so far as a healthy vegetation is concerned. And hence ultimately this result, and indeed this law as universal, that, as the vegetable kingdom is designed to intervene between the air and the earth, to dove-tail and interlace them by its beautiful forms, so does all the material, all the food of plants, tend to accumulate on the common confines of the air and the earth—that is, on the surface of the soil. Our author's chapter on the soil, which is happily the longest, is also the best in his book. What is most to be regretted in it is the temper which he manifests towards those who differ from him, and the disparaging views which he gives of certain experiments of great value, such as those of Messrs Lawes and Gilbert, in England. And, indeed, we only owe it to the good feeling of Dr Blyth, the translator, or possibly to the discretion of the publisher, that we have not a great deal more of this sort of thing; for in the original there is a long introduction which is full of offensive matter, not indeed emitted by the author himself, but by a correspondent of his, some English physician, whom he does not name, but who expresses a very unfavourable opinion of his country as an agricultural field, and of his countrymen as men of science.

But it is time to bring our abstract and criticism to a close. Let us not conclude, however, without acknowledging the great value of this work of this distinguished author. It does, indeed, only deepen the reader's conviction, that much yet remains to be discovered before the men of science can explain the phenomena which are familiar in every farm, or lay down rules for the farmer which shall never mislead him. And, indeed, the art of farming is like the healing art:

considered as a scientific problem, it is too complicated for the present state of science to solve. But some light has been obtained, which is of great value both for its own sake and for practical guidance; and of all those who have contributed to that light, few have done more or deserve better than the Baron Von Liebig.

COAL, AND ITS RELATION TO AGRICULTURE.*

"WE may well call it Black Diamonds," says Emerson, of coal. "Every basket is power and civilisation. For coal is a portable climate; it carries the heat of the tropics to Labrador and the polar circle, and it is the means of transporting itself whithersoever it is wanted. Watt and Stephenson whispered in the ear of mankind their secret, that *a half ounce of coal will draw two tons a mile*; and coal carries coal, by rail and by boat, to make Canada as warm as Calcutta, and with its comfort brings its industrial power."

Though we are the first coal-mining and coal-producing country in the world, we know so little of the extent and probable duration of this great source of our national importance, that, so recently as January 1860, a writer in the 'Edinburgh Review' indignantly exclaims, "Here are Professor Rogers' three beautifully illustrated quarto volumes on one American State, and we have not three illustrated quartos on the whole of our British coal-fields. It is only a few years ago that we learned what our annual produce of coal really was, and it was then found to be so much in excess as to appear incredible. One popular book alone—'Our Coal-fields'—has been recently published on the Newcastle and Durham pits and pitmen, and all that we are likely to learn in addition is from similar publications. Nearly all that has been officially made public of our coal-fields and our colliers is to be found in the generally unread, and, one might add, generally unknown, 'blue-books' of several indefatigable commissioners, whose primary objects were philanthropic and educational. Such a deficiency is a literary reproach to our nation." The vexed Reviewer does not blame the geological survey of Great Britain, which he acknowledges is doing its work well, though tardily. We hope his reverence for three illustrated quartos, costing £8, 8s., will

* 'The Coal-Fields of Great Britain: their History, Structure, and Resources: with Notices of the Coal-Fields of other Parts of the World.' By Edward Hull, B.A., of the Geological Survey of Great Britain; Fellow of the Geological Society of London. With Map and Illustrations. Second Edition, revised and enlarged. London: Edward Stanford, 1861.

not tempt him, or any one else, to despise the handbook of 'The Coal-Fields of Great Britain,' so opportunely published by Mr Hull, after the exciting discussions in Parliament upon the commercial treaty with France, when such abundant proof was afforded of the diversity of opinion and want of reliable data upon the question of the exhaustibility of the British coal-fields.

As guineas are not rife as gooseberries, and as we, moreover, plead guilty to admiring the old Greek who pithily declares "a big book a big bore," we trust our readers will thank us for inviting them to accept the guidance of Mr Hull through those subterranean regions, from which, with such expenditure of toil and money, more than two hundred thousand persons of all ages extract that mineral, the possession of which has made Great Britain the workshop of the world, and stimulated our national energies, and is daily manifesting its influence upon our social condition, and even upon our physical organisation.

The bodily structure and mental character of human beings are influenced, to an extent not sufficiently appreciated, by the comparative abundance and scarcity of the prime necessities of life, among which, in a climate like ours, must fuel be ranked. It has been remarked, that the people in the county of Buckingham became stunted in growth and dulled in intelligence after it was cleared of the wood which sheltered the robbers who infested the district, and that an improvement was perceptible when fuel again became cheap by an extension of inland navigation. In the county of Lancaster, on the contrary, the great abundance and extreme cheapness of fuel are highly favourable to health and comfort; and hence, according to Sir Gilbert Blane, the Lancastrians, especially the females, have become noted for their well-formed persons and handsome faces. In Yorkshire, and other parts of England where fuel is abundant, the people are generally well grown, healthy, and intelligent, and their average height is said to exceed that of the inhabitants of other parts of England where fuel is scarce. The life of the miner is no doubt laborious and dangerous, but yet not so cheerless as represented in a recent and painfully interesting article 'On the Mortality in Trades and Professions.*' "Of human life," says the Reviewer, "they see as little as the train of black ants we watch emerging from their holes." To this it has been truly, we think, replied, that such a description is irreconcilable not only with the facts that their wages are high and their diet good, but with the observation of any one having opportunities of seeing large masses of the collier population washed and dressed. They appear to have as much enjoyment as falls to the lot of any other section of the labouring classes, and to know quite as much of "life" in some departments as is at all desirable. On a market-day at Newcastle the colliers and their wives

* 'Edinburgh Review,' No. 225.

may be seen going to and from the town, not only well dressed and apparently healthy, but in cabs! And on the Race-course, on the day of the Northumberland Plate, the rough-toned but well-garbed colliers will be found quite up to the merits of the respective horses, and ready to bet and pay their sovereigns.

It is pleasing to reflect that they who so largely contribute to the comfort of others are not themselves physically depressed. As to the extent to which their labours affect the general wellbeing, that may be in some degree understood from the following statement.* In France, where fuel is scarce, the average height of a man does not exceed 5 feet 4 inches; in the Netherlands, where it is more abundant, it is 5 feet 6½ inches; and in England, where it is abundant and cheap, it is above 5 feet 9 inches; and in Sweden, where wood is as abundant as coal with us, the peasants are tall and vigorous, notwithstanding the rigour of the climate, their uncleanly habits, and over-fondness for cheap brandy.

While the physical condition of the people inhabiting the British Islands, and consequently the amount of our population and relative political importance among nations, are thus affected by the extent to which we are possessors of fossil fuel, the movements of our people in selecting sites of towns and fields of industry have been regulated by the same cause. Coal is the magnet of attraction which aggregates men in those astonishing places, Glasgow, Sheffield, Birmingham, Leeds, Manchester. Bearing in mind that townward movement—which is so remarkable a characteristic of modern population—it is manifest that political questions, of the gravest moment to the future of this country, will be influenced by the concentration of industry, wealth, and numbers in the coal districts.

As Mr Hull well observes, the uses to which coal is applicable, and the products which may be extracted from it, are almost limitless. In Britain alone it propels 5200 locomotive engines, with their trains, over 9500 miles of railway. It heats 607 iron furnaces, besides those for smelting other ores. It sets in motion the machinery of 3000 factories, 2500 steam vessels and smaller craft, and lights innumerable forges, fires, stoves, and ovens. It unlocks, when heated, invisible gases to illumine our streets, public buildings, and dwellings by night, producing the cheapest, most manageable, and withal most agreeable of lights. When gently distilled, it pours forth streams of pitch and oil, which may ultimately prove so plentiful and easy to procure as to allow the unhappy whale to move at will through the ocean without fear of the harpoon. With the paraffine oil we can light our lamps, lubricate machinery, and, when solidified, produce candles as pure as alabaster. From the tar the most beautiful violet and rose-coloured dyes may be elaborated,

* 'Warming and Ventilation.' By Charles Tomlinson.

and we can unlock the gums, essences, and scents, resembling those of cloves, almonds, and spices, which have lain dormant since the time when the coal-plants themselves were growing.

Our power to defend our national liberties, and maintain our possession of that enormous wealth which always excites the admiration, and not seldom the envy and cupidity, of foreigners, is also a result of our having command of so much of the motive power of the world. The amount of this, and the contrasted littleness of man's physical energy, have been strikingly illustrated by the statement, that England's annual expenditure of power, generated by coal, is represented by that of 66,000,000 of able-bodied labourers. If we estimate a lifetime of hard human work at twenty years, giving to each year 300 working days, then we have, for a man's total dynamic efforts, 6000 days. In coal this is represented by three tons, so that a man may stand at his own door while an ordinary quantity of coals is being delivered, and say to himself, "There, in that waggon, lies the mineral representative of my whole working life's strength." *

Very humiliating, no doubt, in a certain sense. But by this style of reasoning the noblest of God's terrestrial works—man, with his wondrous bodily and mental organisation—is the inferior of many a gigantic brute endowed with bodily vigour. Let us be comforted by reflecting that there is not the slightest probability that armies of gorillas shall ever contest with us the supremacy. From whatever quarter our foes shall come, we may confidently expect never to be ingloriously vanquished, so long as we have abundance of that fuel which generates the power which transports armies and navies, and decides the fortune of war by rapidly supplying its munitions. The change in naval warfare from the wooden walls of old England to the iron sides of gunboats and "rams" is all in our favour, so long as we excel other nations in the productiveness of our mines of coal and ironstone.

To the agriculturist, disquieted by the doleful vaticinations of Liebig as to the coming exhaustion of British soil, we address the like consolation. Whether our rivalry with the nations is to be by sea or land, in the peaceful operations of rural life or in the horrid turmoil of war, the advantage is greatly on our side. Our cotton-spinners have done wonders with "the iron man;" to our modern agriculturists is reserved the distinction of developing the capabilities of the *iron horse*, whose snortings are already heard through the length and breadth of the land, and whose untiring toil will not only add amazingly to the productiveness of our fields, but also diminish essentially the farmer's outlay on horses, and on those yet more costly animals, agricultural labourers. The relation of coal to agriculture is therefore of urgent importance; and no intelligent

* 'Edinburgh Review,' No. 225.

farmer should be unacquainted with the extent of our national property in this most precious mineral, or incurious as to the rapidly-developing application of steam to the multifarious requirements of his profession. Mr Howard, of the well-known firm at Bedford, when recently addressing the Central Farmers' Club, observed :—

“ Until the discovery of this mighty agent, the population and the wealth of England were almost at a standstill. So lately as 1780 we only numbered 8,000,000 ; and 200 years before, the population was 6½ millions. No sooner, however, was the steam-engine fairly brought into use than the wonderful expansion in our trade and commerce commenced, bringing with it a corresponding increase in population. The quick processes and rapid results of the factory have of late years been imported into the thrashing of our crops ; no wonder, then, that the farmer has begun to regard the ploughing of his land by horse power as a slow and tedious operation, and has become desirous of introducing into his fields the same despatch and the same powerful agency he has found of so much advantage in the preparation of his grain for the market. Sanguine men, for two or three generations past, have prophesied that, as surely as steam had in the mine, in the factory, and in transport, become the substitute for horse and other power, so surely would it become the power which would plough our fields, and perform the various other laborious operations in agriculture. Few, very few, imagined five years ago that we were on the eve of so great a revolution in farm practice as that which may now be said to have fairly commenced.”

The enterprising firm of the Howards has already, it seems, sent out about 200 steam ploughs and cultivators. The “generous” Britons, whom the poet called on “to venerate the plough,” which merely scratched the soil and left it to other implements to be comminuted and dressed for the reception of the seed, will probably soon transfer their reverence to the combined steam-cultivator drill and harrow brought out last spring by Mr Smith, of Woolston, at the estimated cost of £50. It is maintained that this combined cultivator will do more towards the application of steam-power on the light lands than any implement hitherto produced. The ordinary terms used in agriculture are already being changed. We read of “steam smashings” costing so much per acre ; and to those who associate such a term with jeopardy to the person, we are glad to give the assurance of Mr Holland, M.P., that our labourers have turned out most excellent and efficient engine-drivers, and that “there have not been many cases of boiler explosions in proportion to the quantity of steam-power that is in use.”

We have no doubt that the application of steam to agriculture will have the effect of stimulating the intellect of the rural labourer. It will never do to allow an ignorant man to have charge of an expensive engine, capable, if mismanaged, of dealing destruction to all around.

And we see no reason why his physical condition should not, from the same cause, be also ameliorated. Millers have a proverbial reputation for being expert in mixing and adulterating the grain

intrusted to them. Quaint old Fitzherbert, 300 years ago, says of grain sent to the miller, "meete to the myll and fro the myll, and se that thou have thy measure agayne besyde the tolle, or elles the myller dealeth not truely with thee, or else thy corne is not drye as it shoulde be." But with steam on his farm premises, why should the agriculturist send his corn to the mill? The chance of receiving it back as flour or meal precisely as it should be in quality or quantity cannot be depended on; the waste of time in sending it to and from the mill is considerable; the delay in getting it from a mill depending on a variable amount of water-power is often annoying. We therefore anticipate that farmers possessing steam-power shall ere long make arrangements for grinding at home the flour and meal required for their men and horses. To those small agriculturists not possessing this power we suggest that they too may protect themselves against fraud and adulteration by encouraging the owners of itinerant steam-thrashing machines to attach to them an apparatus capable at least of grinding meal for the household and the ploughmen, and also of cutting and bruising oats, pease, and beans for the horses and other animals.

We lately threw out this hint to the proprietor of one of these machines, and from the manner in which it was received we are satisfied that a little encouragement from the farmers in his neighbourhood would induce him to act upon it. Pure meal, obtained at the homestead in the manner we indicate, is an object worthy of attention, especially in Scotland, where it constitutes so much of the food of the rural labourer. That it is unconscionably mixed, so as to affect the fiars prices of grain, and thus the incomes of the landholders and the clergy, is unhappily too notorious.

These manifold effects of coal, applied as fuel or as steam, are already abundantly apparent. The continuance of these, and the development of others as yet unknown, but confidently anticipated in a not distant future, depend upon the extent to which the coal-fields of Great Britain can be profitably worked.

Considering the profoundly interesting nature of the many questions relating to the carboniferous rocks, apart altogether from their incalculable utility—bearing in mind, for example, the light which they cast upon the nature of the animated beings and vegetable forms tenantry the globe myriads of years before the appearance of man as a denizen of the earth—we cannot wonder at the zest with which so many now pursue the kindred sciences of geology and palæontology. A more vulgar reason, that of self-interest, recently drew public attention to the coal-fields of this country. The discussion of the commercial treaty with France forced upon the British Legislature the consideration of how far it was expedient to permit the unrestricted export of coal to such a neighbour. "I think," observes Mr Hull, "it will scarcely be denied that Parliament granted an unwilling assent to a measure which gave an unlimited freedom

to the drainage of our resources in the special article of coal. That measure was carried chiefly, though not altogether, in deference to the great principle of free trade ; but even the most ardent advocates of free commercial intercourse cannot but be aware that the doctrine may not be applicable to a mineral which, when once consumed, cannot be reproduced. That we shall ultimately return to the principle of retaining, for our own use, that mineral upon which the wealth, commerce, and political influence of this country so largely depend, can only be a question of time."

Most of our readers will, we suppose, be of this opinion, when informed that no considerable amount of good anthracite, or steam-coal, has yet been obtained from the coal-fields of France, Belgium, Germany, and Russia, and that the far-seeing French Emperor is obviously preparing for the event of possible hostilities with this country, by accumulating in French ports large stores of British coal. Last year we exported to France 1,344,342 tons of coal ; and, while we write, two documents reach us from different quarters, but both bearing on the same interesting matter. The one is the report for October last on the export coal-trade, the other being a Rouen newspaper. The report states that the increase in the export, as compared with the corresponding month of last year, amounts to 239,824 tons ; that from January to September, inclusive of this year, the exports have amounted to 5,997,428 tons, being an increase over the corresponding period of last year of 461,849 tons. It is added, that the exports to Sweden during last October have been already three times greater than during the same month last year ; and that the exports to Denmark, Russia, and the East Indies are proportionably large. The '*Nouvelliste de Rouen*,' while "not giving itself up to conjectures of a premature optimism," is in a state of most pleasurable excitement owing to a proposition received at Rouen from Mr Thompson, Russian consul at North Shields, announcing the proposed establishment of a large steam-navigation company, founded upon a particular system of the construction of vessels, which will permit Newcastle coals to be delivered at Paris, first quality, at 20 francs the ton, and at Rouen 15 francs, and the second quality 10 francs. It is calculated that the quantity forwarded from Newcastle to Rouen and Paris would amount annually to 2,000,000 tons.

Now, remembering that in the year 1700 the consumption of coal in London was only 470,000 tons, and that it now exceeds 4,000,000 tons, and conjecturing that this foreign-export project may also swell out into gigantic proportions, we begin to wonder what will be the effect upon our future. Writing at this moment by a blazing fire of English coal, procured, at a cost of 23s. per ton, from a seaport town connected with us by rail, and distant thirteen miles, we cannot help guessing what we shall have to pay when all monster cities, having access to British coal, receive

their share of the precious mineral! and whether, if we "burn the candle at both ends," we shall not land in the deplorable *finale* of burning our fingers while lighting our neighbours' fires! It may seem cruel to grudge fuel to the frigid Frenchman, cowering round his scanty fire of wood, and it may be contrary to the doctrines of modern political economy to deny anthracite to the Swede desirous to manufacture the finest steel, or to the warlike Muscovite bent on the acquisition of a powerful steam navy; but philanthropy has limits, and free trade in an article which cannot be replaced when once exhausted may be folly. Have these limits been overstepped? Has that folly been perpetrated by recent legislation in regard to the free export of coal? These are questions which we may quietly discuss at our firesides without involving ourselves in the strife of party politics, and about which all reflecting men will gladly receive information. They are of interest to every owner of a coal-scuttle, not to speak of a steamship or a steam-plough. We shall therefore discuss them, with the help of the valuable materials furnished by Mr Hull, whose connection with the Geological Survey is sufficient guarantee for the extent and accuracy of his information.

"Of Britain," he observes, it may be emphatically said, "whose stones are iron, and out of whose hills thou mayest dig brass." These being the words of the authorised version of the Scriptures, Mr Hull is justified in quoting them in illustration of the immense extent of British minerals; but *brass*, being a compound metal, is never found in a native state; and, for the information of those geologists who find discrepancy between scriptural statements and scientific knowledge, we think it right to add that, among the useful products of Palestine, Moses enumerates *copper*. Less open to question is the statement that Britain has erected more altars to Vulcan than any other country, and that the products of her carboniferous rocks—the coal, ironstone, and limestone—have enabled her to take the foremost place in industrial arts.

The coal-measures of England rest upon a series of hard and coarse sandstones and shales called millstone grit, this again on a thick series of black shales, which pass downwards, by the intermixture of thin courses of limestone, into the great calcareous deposit, the carboniferous limestone, which in Derbyshire attains a thickness of 5000 feet, and is almost wholly composed of the shells of mollusca, the calcareous habitations of corals, or the broken skeletons of "stone-lilies."

The coal-field of South Wales is the largest in Britain, with the exception of the Clyde Basin, and contains almost as great a vertical thickness of strata as any coal-field in the world, amounting to upwards of 10,000 feet. Out of this enormous mass of fuel might be cut a mountain about three times the height of Snowdon, having a basis of a thousand square miles and which, as Mr Vivian has

shown, could supply the consumption of Britain for nearly 5000 years. This coal-field, if opened up to an extent commensurate with that of Yorkshire, ought to yield 13,000,000 of tons annually.

Our limits not permitting detailed description, we shall merely glance at some of the other great deposits of English coal. The coal district of South Staffordshire is two miles long, and of an average breadth of seven miles; and its productiveness in coal and iron has given an extraordinary impulse to the industry of the towns of Wolverhampton, Dudley, and Birmingham. On a fine night the spectacle from Dudley Castle, which rises from the centre of the coal-field, is one which has scarcely a parallel. The whole country, within a radius of five or six miles, is overspread by collieries, iron-foundries, blast-furnaces, and the dwellings of a dense population; and from amidst the smoky atmosphere the tongues of fire from the furnaces shoot up an intermittent light which illuminates the whole heavens. But the spectacle before our eyes does not represent the whole sum of human labour; for whilst ten thousand hands are at work above ground, one half as many, perhaps, are beneath the surface, hewing out the coal which is to be the prime mover of the whole machinery.

The North Staffordshire coal-field, though of smaller area than that of South Staffordshire, has vastly greater capabilities—the strata being about four times as thick, with twice the thickness of workable coal. The industry of this region is equally remarkable. Here are “the Potteries,” a group of populous towns, from which all parts of the world are supplied with china-ware, rivalling that of Dresden, with vases and vessels after Etruscan patterns, but adorned with paintings from natural models, executed with a perfection never attained by Etruscan art.

The great coal-bearing tract of Lancashire attains an extreme length of thirty-two miles, with an average breadth of six miles. The quantity of coal raised in 1859 was 10,650,000 tons. Taking the future production at 11,000,000 tons, there is supposed to be coal sufficient to last for 363 years. That, no doubt, is a tolerably long date; still it is not comfortable to think that the glory of Lancashire may possibly depart within a much shorter period. Geologists are not infallible in their rough guesses as to the quantity of minerals stored in unexplored depths of the earth.

The Derbyshire and Yorkshire coal-field is the largest in England, and about 150 square miles smaller in area than that of South Wales. In Derbyshire the principal coals are the “top hard” and “lower hard” seams, producing the most valuable splint coal; and in Yorkshire the most remarkable are the “Silkstone” and “Barnsley” thick coals. The former is identical with the “Arley Mine” of Lancashire; and thus this fine bed of coal, which seldom exceeds 5 feet in thickness, has originally spread over a tract embracing not

less than 10,000 square miles. The total available quantity of coal is estimated at 16,800,000 tons, which, at the present rate of consumption, would last for 1340 years.

The great northern coal-field of Durham and Northumberland extends from Staindrop, near the north bank of the Tees, on the south, to the mouth of the Coquet, where it enters Alnmouth Bay, on the north, the distance being nearly 50 miles. The available amount of fuel which it contains is estimated at 7,226,000 tons, which, at the present rate of consumption, would last about 400 years.

Turning to the coal-fields of Scotland, we lament the absence of those illustrative woodcuts which so distinctly exhibit the general aspect of the coal regions of England. Comparative brevity also characterises this part of Mr Hull's instructive volume. In this respect those disposed to stand up for Scottish rights may find fault not only with Mr Hull but with Æneas Sylvius, afterwards Pope Pius II., who, writing about the end of the fourteenth century, notices, with surprise, coal given as charity to the poor, but finishes off his account of Scotland within the space of a single page; which, however, is as much as it had any reason to expect, seeing that the whole of the British isles is graphically portrayed by three times that quantity of letterpress, and a sketch-map, of very easy comprehension, as it ignores distance, and is remarkable for simplicity of detail.

The carboniferous region in Scotland is comprised within the area whose western margin is washed by the Frith of Clyde, and whose eastern limit is the North Sea on both shores of the Frith of Forth. The extreme length from the coast of Ayr to Fifeness is 9½ miles, the average breadth being 25 miles. We cannot follow Mr Hull in his descriptive details. This sentence, however, will be interesting to many:—"The Boghead coal, in the county of Linlithgow, the object of a celebrated trial at law, one of the most valuable of the brown cannels of Scotland, occurs in a small area, and is of an average thickness of 18 inches, but reaches in some places 30 inches. It is a true coal, as it rests on a bed of fire-clay, full of *stigmæria*, and is surmounted by shale and ironstone, with plants and shells (*Anthracosia*). It yields about 70 per cent of volatile matter, and is in high request for the manufacture of paraffine oil."

The total available quantity of Scottish coal is estimated at 25,323,000 tons, which, at the present rate of consumption, would last for 2450 years.

That Ireland was once covered, over two-thirds of its extent, by coalbeds, may be confidently affirmed on geological grounds; "but the misfortune of the sister isle began long before the landing of Strongbow, for old Father Neptune has swept the coal and coal-strata clean into his lap, and left little but a bare floor of limestone

behind." The produce of all the Irish collieries, numbering forty-five, was, in 1859, only 120,400 tons.

Turning from details, the broad tangible results are these: In Great Britain there are 5431 square miles stored with coal to a depth of 4000 feet; and the quantity of available coal within the same horizontal and vertical limits is 79,843,000 tons—sufficient, at the present rate of consumption (72,000,000 of tons), to last for upwards of 1000 years.

With such prospects it may seem absurd to dread the exhaustion of our carboniferous fuel. But it is to be borne in mind that a coal-field may be said to be exhausted when it is necessary to import largely from neighbouring districts for manufacturing and more general purposes. When lately in the parish of Newton, near Dalkeith, we were informed that the population would soon be largely diminished in consequence of the coal being wrought out. Mr Hull gives two illustrations of a decreasing supply causing a sensible rise in the price of coal. The exhaustion of the southern portion of the South Staffordshire coal-field is already telling on the price of coal in North Staffordshire. Coalbrook Dale, in Shropshire, is fast approaching extinction as a coal-producing district, and the consequent deficiency will largely add to the drain upon the neighbouring coal-field of Denbighshire.

Moreover, fixing on 4000 feet as the depth beyond which coal-mining cannot be profitably or even safely prosecuted, there are in some districts coal-seams at a depth of 6000, 8000, and perhaps 12,000 feet beneath the surface; and which, for practical purposes, until some tremendous convulsion of the solid globe shall alter their position, might as well be buried beneath the waters of the Atlantic. "Can a thing be lost when you know where it is?" said a servant to his master. "Surely not." "Oh, then, your tea-kettle isn't lost though it's in the bottom of the sea?" From this old Joe Miller we fear few will derive much consolation. We know where there are mines of "black diamonds," but these mortal eye shall never see till the earth is turned upside down.

The discussion as to the physical limit to deep coal-mining leads to the consideration of various interesting phenomena relating to the interior condition of the globe.

That the earth has once been a fluid mass, which has subsequently cooled down at the outer surface by radiation into space, is demonstrated by the existence of fire-formed rocks, the outbursts of hot springs, and volcanic fires, and by the well-ascertained fact that subterrestrial temperature increases at an average of one degree of Fahrenheit for every 60 feet. In general it is found that, at a depth varying from 15 to 50 feet, the temperature remains constant, and nearly that of the average temperature of the atmosphere. The depth of this "invariable stratum" depends, according to Humboldt, on the latitude of the place (increasing from the equator to the poles),

in the conducting power of the rock, and on the amount of difference between the temperatures of the hottest and coldest seasons. That the increase in the earth's internal temperature is independent of atmospheric agency, or the elevation of a place relatively to the level of the sea, is proved by the observation of Humboldt, who found that the temperature of the Mina del Purgatorio (situated in the Andes of Peru, at an elevation of 11,875 feet above the sea) was 25.4° Fahr. higher than that of the external air.

The source of the earth's temperature being internal, and independent of the form or elevation of the ground, if we are justified in assuming that the internal heat is such that, at a depth of about 2500 feet, the mean temperature would equal that of the tropics—90°—this depth must be the limit of mining operations, unless the temperature can be lowered by artificial appliances. This is effected by ventilation to such an extent that, at the bottom of a deep pit, water has been frozen several inches thick; so that if the current of air should descend the shaft, and enter the works at a temperature of about 35°, there is every probability that it would reduce the heat, even of a mine 4000 feet, to such a degree as to admit of healthy labour.

So far all looks satisfactory in regard to the future. But there is a dismal possibility that our flourishing greatness, so far as dependent upon coal, *may* come to an end in 172 years; and this horrid *finale* is, it seems, inevitable, if the increase in our supply of carbonaceous fuel shall only be doubled, which has been the rate of increase for twenty years preceding 1860.

Mr Hull's reasonings against the probability of such a calamity are not so reassuring as could be wished. It is only to be avoided by the concurrence of various events which may never happen, and which cannot be expected for an unknown period. Among these is reckoned the cessation of our already enormous exports of coal; a saving of *it*, no doubt, but inferring a serious reduction in the amount of our national resources. If we cannot continue supplying the world with fuel, many a man's purse must collapse into emptiness, and many a vessel of our mercantile navy be broken up for firewood. As to receiving our future supply of coal in huge vessels like the "Great Eastern," laden at transatlantic ports with the inexhaustible products of New World coal-fields, we must say that we do not relish the prospect of the vigour of our national life being regulated by the somewhat capricious benignity of our American cousins. Mr Hull tells us that we are short-sighted creatures, and that God is as merciful as He is wise in denying us the power of far pre-vision. Granted; but we are not so assured as he seems to be that the exhaustion of our own coal supply, however near or remote, need not disquiet us *because* America is ready, when the time arrives, to stretch forth a helping hand. Brother Jonathan's hand has been so often shaken in John Bull's face that it is not absolutely

certain that he will never be tempted to try the experiment of lowering John's strength and spirit by treating him with a little starvation—that proverbial way to tame a lion! The progress of steam navigation leads to the expectation that, ere long, the average passage across the Atlantic will be reduced to seven days; and it is therefore possible that distant countries, rich in coal, may step in and undersell our own colliery proprietors. When such a state of matters arrives, and we become mainly dependent upon America for the supply of that which now makes us envied among the nations, we confess that, in our poor judgment, we must be shorn of our strength; nor are we certain that the Philistines will not mock the fallen Sampson.

Mr Hull, contemplating the transference of the coal trade to America, is sanguine enough to hope that the British isles shall remain the workshop of the world, notwithstanding the new impulse which would thus be given to the westward progress of civilisation. "The pleasures of hope" afford a fine theme for the poet, whose creative faculty can conjure up new cosmical arrangements, under which all shall be bright and beautiful. Statesmen, patriots, and men of science, should beware of beguiling a nation into a fool's paradise. Let us husband the resources of our highly-favoured land; and, remembering the senseless waste that has too long prevailed, let us act on the conviction that it is a crime to waste a single ton of coal. Mr Hunt, whose mineral statistics have excited so much attention, calculates that, for every additional person born, an additional ton of coal is required. And though science will doubtless know how to eliminate the latent caloric everywhere around us, and though light and heat will thus be economically provided from sources with which we are as yet unacquainted, we should never forget that, for increase of population alone, we must allow an increase in our consumption of coal of 1,000,000 of tons for every five years. Mr Hull exhorts us not to suppose that any part of the Creator's universe has been regulated on so short-sighted a plan that it shall become disorganised, because some of the elements necessary to its economy have failed. As believers in eternal providence we should, indeed, adore the Divine wisdom, power, and goodness, which have so arranged that those rays of the sun which have been locked up in the rocks since the decay of the primeval forests shall reappear in our day in the heat of burning coal. Nay, extending our view to the appearing of a new heaven and a new earth, we should still "assert eternal providence and justify the ways of God to man." All evidence is in favour of the belief that coal is essentially of marine origin, and that there must have been an enormous subsidence of the sea-bed, and a measureless lapse of ages, prior to a formation of a series of strata, with their coal-seams, several thousand feet in thickness. If, then, the present inhabitants of our globe have been beneficently cared for by the Almighty calling into action those igneous forces which have

upheaved oceans and submerged mountains, we may find consolation greater than Mr Hull administers, in believing that the earth, as Humboldt declares, has not lost its property of being elevated into ridges, inclined in different directions. All geognostic phenomena indicate the periodic alternation of activity and repose; but the quiet we now enjoy is only apparent. The tremblings which still agitate the surface under all latitudes, and in every species of rock, the elevation of Sweden, the appearance of new islands of eruption, are all conclusive as to the unquiet condition of our planet.

If, then, the subterranean fuel, needful for the comfortable existence of our race, shall ever be so exhausted as to be beyond our reach, let us be confident that, by gradual alteration in the relative position of the sea and the land, or by volcanic displacement of the earth's strata, access shall be afforded to the riches stored up in the valleys of the ocean, and in the depths of the everlasting hills, by Him who knows how to provide for all the generations of His children.

We cannot at present discuss many questions connected with the coal-formation. We have limited our critique to the interesting and valuable little work of Mr Hull. Those desirous of more extensive acquaintance with a very important department of knowledge should study the 'Essays on the Coal-Formation, and Description of the Coal-Fields of North America and Great Britain,' annexed to the Government Survey of the Geology of Pennsylvania, by Henry Darwin Rogers, 3 vols. 4to, with plates, which magnificent and elaborate work, we are confident, should be in all our public libraries, as well as on the book-shelves of all students of geological science.

SOMETHING MORE ABOUT THE HATCHING OF FISH AND
THE EATING OF HORSES.*

WE have done something, we hope, to make the readers of this Journal interested in the very important question, How is animal food to be provided for the rapidly-augmenting population of the British Islands? We have pointed out that, in the ocean by which they are surrounded, and in the lakes, rivers, and canals by which they are intersected, bountiful nature has provided for all her children alimentary substances of the greatest value, and to an extent which, without exaggeration, may be pronounced inexhaustible. Let human beings be multiplied in such myriads as to horrify Malthusians, our "cheerful faith" is that the great Father has made the fish-pond of the seas and rivers bear such a proportion to the families to which He has given "the dry land" as their dwelling and harvest-field, that food shall not fail, provided advancing intelligence and industry be unceasingly applied to the solution of the increasingly intricate problems of our social life. This *proviso* being attended to, we may hope for something better than was prayed for by the benevolent King of France, who wished that every peasant might have a fowl in his pot. We are sanguine that salmon shall again smoke on many a farmer's table, and even find its way to the kitchen and the bothy; that oysters shall be multiplied countlessly on many a depopulated scalp; that superior species of fish shall swarm in many of our streams; and that our population generally shall become ichthyophagous to an extent as yet unknown.

Does any one ask a reason for this faith in the increase of fishes? Did we not read, this very day, in an Edinburgh newspaper, an advertisement headed "Fish *versus* Butcher-meat," with the pleasant notification, that cod and skate, haddock and halibut, might be had at from 2d. to 3d. a pound? Last week, did we not read of the great joy in a fishing-village on account of the capture of a skate so huge as to be a burden to three lusty fishermen, though this be a fish generally of small repute in Scotland? And, greatest marvel of all, have not Her Majesty's faithful Commons benignantly thought of the multitudes living on short commons, opposed the Government, and victoriously supported Mr Fenwick's motion for a commission to inquire into the means of improving the sea-fisheries of Great Britain and Ireland? In spite of those who think that the end of the world is at hand, we really believe, with Galileo, that it is moving, and in the right direction too—not to perdition, but in

* 'Fish Hatching.' By Frank T. Buckland, M.A., M.R.C.S., F.Z.S., Student of Christ's Church, Oxford, and late Assistant-Surgeon, Second Regiment of Life Guards. London: Tinsley Brothers. 1863.

the divinely-appointed path of procreation and progress. The mission of human beings is to people the earth. In fulfilling it they must learn to reap crops alike on land and water : in both seed must be cast. And if we have not lost all faith in Providence, and in the assertions of philosophers seriously addressing themselves to the question how food is to be found commensurate with the increase of the world's population, we may confidently expect an ample reward to the labours of *aquaculture*.

"We are," says Mr Buckland, "for the most part fully cognisant of the inhabitants of the land, but how little do we know of the inhabitants of the water ! Man has dominion given him over both land and water. Of the former, he has taken every advantage ; from the earliest times there have been *agriculturists*, or land farmers. Who ever heard of an *aquaculturist*, or water farmer ? " We have ; and Mr Buckland might have heard of him too, if he had chanced to read a remarkable letter of Mr O'Ryan de Acuna, published in 'The Field,' August 8, 1857, by Mr Thomas Ashworth, to whom it is addressed :—

"In lieu of pisciculture, which would only include *vertebratæ*, I shall continue" (writes this gentleman, who has obtained the privilege of bringing under cultivation the waters of Spain) "to make use of the word '*aquaculture*,' as including within its signification the other orders of zoology, the cultivation of which, in molluscæ and zoophytes, has also been recently practised on principles of sound philosophical induction.

"Aquaculture has certainly not obtained, up to the present day, that profound attention which its vast importance entitles it to. We are in the habit of seeing the earth being cultivated, but our ideas have not yet been awakened to the propriety of cultivating the water likewise. Everybody knows there is a period in the life of human societies, during which even the earth is not cultivated. In that period the spontaneous productions of the earth suffice to satisfy the necessities of the individuals composing such communities ; but as soon as they are about to abandon the savage state, agriculture becomes necessary, and consequently it takes rise. The necessity of cultivating the waters, on the contrary, does not show itself before the moment in which communities have acquired a high degree of civilisation ; at which time the application of aquaculture becomes no less indispensable than that of agriculture at the instant savage life had to be relinquished. No doubt, the cultivation of the water becomes a necessity at a much later epoch than the cultivation of the earth ; but this arises, in a great measure, from the lesser control we possess over the waters, and equally so from their superior fecundity to that of the land ; and such a superiority affords strong argument for the incalculable advantage that may accrue from an intelligent and ample system of cultivating the liquid surface of our planet. If we look rightly into the matter, it would appear absurd to deny that the time is not actually come for us to be obliged to bring the waters under cultivation."

Mr Buckland will, we doubt not, rejoice to learn that the water farmer has not only been heard of, but is already located through wider portions of the world than he (Mr B.) seems to be aware of. In the appendix to his very amusingly written as well as useful little book he gives, for the benefit of his inquiring readers, as complete a list as he can of works on pisciculture. It does not include

that of M. Jourdier, published in 1856 for a couple of francs, and forming part of Hachette & Co.'s Railway Library. "This work," observes the distinguished M. Coste in a commendatory preface to the reader, "is of a double utility, being the most complete published up to this date, and comprehending both marine industry and the rearing of leeches." In No. 64 of this Journal we treated of the singular rural economy practised in France under the name of Hirudiculture (leech-culture); to make known the importance of which we trust Mr Buckland may be induced to turn his facile and hilarious pen. We now refer to M. Jourdier's cheap and excellently illustrated work for the purpose of indicating to those in search of piscicultural knowledge, where they may find a list of books far more extensive than that furnished by Mr Buckland. It fills more than two pages, and should be consulted by all pisciculturists able to read French.

Now that so much interest has been excited, it may also be of benefit that our readers should know where to find our own writings, which, we understand, have aided in directing public attention to matters relating to fish and fisheries. They may be found in this Journal in the following order:—No. 56 (March 1857); and No. 57, Salmon and Pisciculture; No. 60, Parr *versus* Pisciculture; Nos. 65, 66, 67, Maritime Pisciculture—an abrége of M. Coste's splendid 'Voyage d'Exploration,' with special notice of oyster, mussel, and eel rearing; No. 69, Scotch Salmon and Scotch Law; No. 74, Salmon, British and Colonial; No. 76, The Salmon Rivers of England and Wales; No. 80, Salmon-rearing at Stormontfield, and Fish-culture.

We are glad that this Journal has thus been the means of diffusing much fish lore not accessible to the general reader, and only to be acquired by acquaintance with a new department of literature much cultivated abroad, and now becoming known in this country by communications to 'The Field,' and by the writings of the late Dr Esdaile, Mr Thomas Ashworth, Messrs Buist and Brown, Perth; and more recently of various writers in England, among whom may be mentioned 'Ephemera, or the Book of the Salmon;' Mr Francis; and, latest of all, Mr Buckland, whose good-natured rollicking style pleases the general reader, while his extensive and accurate information satisfies the more scientific inquirer. We hail him as an ally, and claim the fulfilment of this promise—"The oyster must and *shall* be cultivated in this country. I propose shortly to take the matter in hand. M. Coste and the French pisciculturists have done so much that we ought to be ashamed of ourselves for being all behind-hand in this important matter."

In Scotland we have especial reason to look foolish and to be ashamed. The artificial rearing of the mussel is very easy; and yet this bait, indispensably required by fishermen, is now so scarce that the whole of the east coast near Arbroath is supplied with mussels from the Clyde; the cost of dredging being 10s. 6d. per ton, and

the carriage per rail to Arbroath 15s. per ton. The Clyde mussels are now sent as far as the Moray Firth! The Scotch are generally reckoned wise in their generation; but in the management of our fisheries we are as great fools as our worst enemies could wish us to be. Well may Mr Buckland declare—

“We have been asleep—we have had gold nuggets under our noses, and have not stooped to pick them up. Tons of fish, worth thousands of pounds, only want a net placed round them to be converted into bank notes; but they want looking after; they want cultivation. You must not kill your ‘golden fish’ (the ‘golden goose’ may now retire on half-pay), you must not watch the spawning fish-mother to her nest, nor must you permit others to do it—for the sake of her unwholesome carcass (for which the French cook at the Palais Royal will give you a franc or two) destroy her, and at the same time thousands of young fish.

“*O fortunatos nimium, sua si bona norint*, would dear old Virgil have said of the *aquæ*-culturist, if he had known what we now know. You must not, O friend, put your heel upon yon mass of tiny round balls, which, if properly treated, would most assuredly in about four years develop themselves into huge, silver-coated salmon, and, what is more, will cost you not a penny for food or keep.”

We demur to the statement that it may take “about four years” to develop a tiny smolt into “a huge salmon,” if we are allowed to apply such an expression to a fifteen-pounder,—a “huge” increase, at all events, from about two grains, the weight of salmon fry three days old. Mr Buckland forgets the following observations of Mr Ashworth of Cheadle, near Manchester:—

“The fry, at three days old, is about two grains in weight; at sixteen months old it has increased to two ounces, or 480 times its first weight; at twenty months old, after the smolt has been a few months in the sea, it has become a grilse of eight and a half pounds,—it has increased 68 times in three or four months; *at two years and eight months old it becomes a salmon of twelve to fifteen pounds in weight.* After which, its increased rate of growth has not been ascertained; but by the time it becomes thirty pounds in weight, it has increased 115,200 times the weight it was at first. I do not suppose there is any other animal that increases so rapidly and at so little cost, and that becomes such a valuable article of food.”

The rate of salmon growth, after attaining maturity, not having been satisfactorily ascertained, we invite the attention of Messrs Ashworth and other observers to what we wrote in No. 56 of this Journal:—“The age of a fish has hitherto been difficult to ascertain, but Mr Bocceius asserts that by means of the microscope he has discovered that the laminations of the scale are readily detected, and that these denote the age the same as the rings on an oyster shell. This seems to be an old idea, for we find Mr Fraser, in his natural history of the salmon, referring to M. Buffon as examining the scales of a carp, for the purpose of ascertaining his age, and finding him to be no less than a hundred years old.”

As Mr Buckland is expert in the use of the microscope, and can easily procure the aid of others of still greater experience, we com-

ment to his care this interesting field of observation. We have met with no corroboration of the statement made by Mr Boccius, and are consequently the more anxious that its accuracy should be tested.

The anomalous diversity of growth in young salmon, so very remarkably illustrated at Stormontfield, is, we think, still a mystery. In the office of the conservator of the Tay fishings were three specimens spawned from salmon roe about the end of December 1861, hatched in April 1862, fed in the same pond, and yet exhibiting these peculiarities. The first weighs 646 grains; the second, 135 grains; the third, 26 grains. Our worthy old friend "Peter of the Pools," *alias* Mr Robert Buist, Perth, being desirous to have the opinion of a distinguished naturalist as to the cause of this strange anomaly, sent these fishlings to Mr Buckland, who thus replies :—

"I submitted the specimens and letter of 'Peter of the Pools' to the scientific meeting of the Zoological Society. J. Gould, Esq., F.R.S., and Dr Günther of the British Museum, gave it as their opinion that, provided always the evidence of their being of the same age is well proved, this was simply a case of cause and effect—the bigger fish being the stronger and most healthy of the lot. I myself quite agree with this. A number of fish are turned out simultaneously into a pond; some are weak, some are strong; the stronger, of course, gain the mastery over their brethren, and gain all the advantages of the pond, whatever these may happen to be; the consequence is, that, in proportion to their advantages, they become larger than those which have them not. The same thing happens, so to say, in human ponds; for in large cities we find that the babies and young children who are well fed and live in good air, are much stronger and healthier, and, for the most part, larger too, than those born and bred in crowded courts and back passages, and who feed on red herrings and tea rather than on butcher's meat and beer. Take a given number of children from a given large city, say a hundred of the same age, and put them side by side. I doubt not that we should be able to pick out three specimens from among them whose full-length photographs, if grouped together, shall show as much difference as do the drawings of the three fish now before the reader."

He then relates the result of a dissection by himself next day, which showed that the stomach of the smallest specimen "contained nothing, or positively next to nothing;" and the conclusion arrived at is, that the two larger specimens, whose stomachs were full, were indebted to differences of natural vigour, and also of food, for their remarkable size.

Now, with all deference to learned zoologists, we cannot accept this as a solution of the phenomenon which all along has puzzled the Stormontfield experimenters; and, though we have not had time to communicate with them, we venture to prognosticate that they are not satisfied with the philosophy of Mr Buckland, who argues, if we find a specimen of "a little old man," why should we not find "a little old fish?" We beg pardon for asking, Is not Mr Buckland a little of an odd fish? He writes as if the common diet of babies and young children in great cities were either red herrings and tea,

or butcher's meat and beer. If it be so in England, we have an explanation of juvenile mortality, for the checking of which we advise "parritch."

Moreover, as "Frank T. Buckland, late Assistant-surgeon Second Regiment of Life-Guards," may be reasonably supposed not to have had very ample opportunity of introducing babies into her Majesty's dominions, we should like to have the opinion of Dr Simpson of Edinburgh on this question. Three young salmon, known with certainty to be of the same age, and to have been supplied with the same kind of food, are found at the end of twelve months to be of the respective length, $6\frac{1}{2}$ inches, $3\frac{3}{4}$ inches, $2\frac{1}{8}$ inches. In any "human pond" with which you are acquainted—in Charlotte Square, Edinburgh, for example—do you know of like diversity among babies, born at the same time, of healthy parents, and fed in the same way? And is it consistent with your experience that, at the usual age, fifty per cent of female children attain the size of puberty, and the capacity to perform all its functions; but that other fifty per cent do not attain that size and capacity, and remain at home, saying, like the sweetheart of "My boy Tammie,"

"We're ower young to marry yet,
We canna leave our mammy"?

Until Dr Simpson answers these questions in the affirmative, we are confident that "Peter of the Pools," and his well-informed piscicultural coadjutor, Mr Brown, will think that a very shallow explanation of a deep mystery has been all that they have got from the Zoological Society. The truth is, Mr Buckland and his learned friends have misapprehended the nature of the puzzle submitted for their solution. He writes as if the anomalous growth of salmon only amounted to three per cent; whereas it is nearer fifty! About a half of the Stormontfield fry do not at the end of the year exhibit the silvery lamination of the smolt, and refuse to leave the rearing-pond; while the other half, greater in size, and protected by a different sort of scales, insist on getting to the sea; from which, in about forty days, they begin to return as grilises. This anomaly cannot be explained, either by the "little old man" similitude of Mr Buckland, or by the difference in food theory of Mr Gould and Dr Günther. It is, we suspect, somehow connected with the recently discovered habit of the salmon species, which occasions a double or divided migration to the sea as smolts, and from the sea in their later stages. When this is better understood, we shall, doubtless, be furnished with new proof of Providential wisdom.

Mr Buckland, as well beseems a late assistant-surgeon, treats his readers to "a bit of anatomy."

"Here," says he, "is a preparation from a salmon, which shows that the ova are thrown off from a long finger-like membrane, one side of which is laminated like the leaves of an opened book; it is in these leaves that the ova are secreted, and some of them may be seen still adhering *in situ*."

"I have ascertained that behind the ova, ready to be extruded, say this year, are other ova, as small as pins' heads, which will arrive at maturity next year. When the ova are ripe, they detach themselves from the membrane, and lie quite loose in the cavity of the abdomen; they are not, however, I believe, all shed at the same moment, but at various intervals—so say observers of salmon spawning. They say correctly, as it is not likely that all the ova should become loose at the same moment."

Attention to this ascertained fact must be paid by all prosecuting pisciculture by means of artificially impregnated ova. Excess of pressure endangers the parturient fish; and ova prematurely extruded by the manipulator, are not in the condition for being impregnated by being mixed with the milt.

When impregnating the ova of trout from the Wandle, Mr Buckland remarked, for the first time, that the ova of some of the trout were of a splendid coral—red-coloured; others, on the contrary, were almost as white as peas, yet all good eggs. This depends, it is said, upon whether the trout is red-fleshed or white-fleshed. And we subsequently ascertained that the young fish hatched from the red eggs were much brighter than those from the yellow. A correspondent informs him that the same great variety exists in the colour of grayling ova, though the parents in that fish are not red-fleshed; and also points out that, though we have no red-fleshed hens, there is a variety of colour in the eggs daily presented at the breakfast-table. He adds, "the pale and the red fish ova are equally fertile, and the colour does not depend on the age of the parents. These two points I have proved. I cannot believe it to depend on colour of flesh, and therefore attribute it solely to variety in feeding."

With this statement we were disposed to concur, as we constantly observe that, when our fowls are not properly fed, the yolks of their eggs are pale and flavourless. But we were quite at a loss to explain why the shells of our chittagong's eggs are pink, while those of our Spanish fowls are white. As they receive the same sort of food, the difference in the colour of the shells seems to indicate that this is a characteristic difference of species. And if it be so with the eggs of fowl, why may not difference in colour also indicate like difference among fish? Consequently, the first point to settle as to different-coloured fish eggs, is whether they have been taken from the same variety of fish.

The ova of fish are exceedingly hard and tough, and so elastic as to rebound from the floor like an India-rubber ball,—a beautiful provision to prevent them being crushed or injured by the stones amongst which they are deposited.

"I was much surprised," observes Mr Buckland, "to find the eggs of the trout at such a considerable depth in the gravel, certainly from one to two feet. They were all about loose in the gravel, reminding one of plums in a pudding. I cannot understand how the trout manages to get her eggs so deep in the sand. They certainly sink in the water; but one would fancy the current would whip them away in a moment. Again, how are they not

crushed? I have stated above that their coats are very elastic; but I had no idea they were so tough. In order to ascertain positively how much direct weight they would bear, I tried experiments on the eggs, by placing iron stamped weights on individual eggs. I was astonished to find that they were not crushed till I had placed no less than five pounds six ounces on them."

This elastic toughness facilitates the transport of fish ova for the purposes of pisciculture; and experience has demonstrated that they can be safely transported hundreds of miles, either by land or water, if carefully packed in layers of moist moss, or of rough sponge, the size of a walnut, and well cleaned. The boxes of ova sent to London from the famous fish-rearing establishment of Huningue, usually occupy from two to four days in the transit; which is safely effected in consequence of the French pisciculturists insisting on observance of this simple rule—*never attempt the removal of ova till the eyes of the fish are plainly seen in the egg.*

The expense of collecting and removing ova is trifling. In December last the superintendent of Messrs Ashworth's Irish fishings collected and deposited seven hundred and seventy thousand salmon ova in the streams of Lough Mask, besides conveying alive forty adult salmon a distance of twenty-three miles in a large tub of water. The cost of this very laborious-looking operation was only *eighteen pounds*, in addition to the weekly cost of the staff of water-bailiffs and workmen.

We are delighted to learn that there is such a reasonable prospect of success at last rewarding the zeal of those who as yet have failed in their repeated efforts to introduce the ova of British salmon into the salmonless rivers of Australia. It is proposed to effect their transmission by packing them in ice; and the reason for hoping for a happy issue to the novel experiment is this: Life has been found in salmon eggs taken from the wells of the Wenham Lake Ice Company, London, after being deposited in the ice fifty-nine days. This encourages the belief that the retardation of vivification during the voyage by freezing the ova in ice, and hatching them on their reaching their destination, is the most likely way of gratifying the anxiety of the Australians for the introduction of the salmon into the rivers of the antipodes.

If our article in this Journal of March 1858 had been considered by those interested in the experiment of transmitting salmon ova to Australia, the trial of the effect of freezing ova might have been made years ago. We then wrote: "In order to prevent unnecessary pains to protect salmon ova from the effects of cold, it should be known that, if gradually applied, it does not injure them, and that they have been known to be frozen up in a sheet of ice without losing their vitality. Reaumur demonstrated that the eggs of many insects are equally uninjured by excessive cold."

The temperature of fishes, as we stated in the same article, on the

authority of Liebig,* is from 2.7° to 3.6° higher than that of the medium in which they live ; and, as a warning that their ova are far more apt to suffer from excess of heat than from excess of cold, we related the failure of the attempt, made at our suggestion, to rear young salmon at the Crystal Palace, Sydenham. Instead of being in a temperature of about 40° Fahr., the ova, sent from the Tay, were placed in the tropical department, contrary to our wishes, and could not endure a temperature of about 60° . In like manner Mr Buckland's young fish sickened at the same degree of heat arising from the direct action of the sun, and were only saved by the prompt application of ice. And the London pisciculturists have now arrived at the conclusion that the young fry soon begin to pine if the thermometer marks many degrees over 55° .

We have alluded to the inexpensiveness of the first step in the process of pisciculture—namely, collecting and depositing the eggs. The hatching apparatus, our readers will rejoice to learn, is neither costly nor cumbrous. That patented by Mr Boccus, and sold at the ridiculous price of £10, 10s., though capable of containing 25,000 salmon ova, is only two feet long by one broad, and requires not more than four inches depth of water. Those used by Mr Smee, and exhibited at the 'Field' Office, 346 Strand, London, may be made either of zinc or earthenware, and are 20 inches long, $4\frac{1}{2}$ deep, and 6 wide. They can be placed one above the other, like the steps of a stair, so that the water shall fall from the one to the other by means of lips. These boxes may contain either a series of glass rods, on which the eggs can sit, which is a neat and clean way of hatching them ; or may be filled with half-inch gravel, *boiled*, in order to ensure the destruction of pernicious insects and animalculæ. "By next September or October," says Mr Buckland, "I shall be able to tell the reader where these may be procured, or, anyhow, can give him a model." This is very obliging ; but, without availing ourselves of his offer, we can readily supply ourselves with a cheap and effective hatching apparatus, either for the parlour window or the park. We only require to read any illustrated work on pisciculture,† in order to understand what is needed ; and with our own hands, or the help of a carpenter, it may be readily constructed.

Mr Buckland writes very pleasantly regarding the enemies of fish while in the ova, or after being developed. The common house-rat finds the ova a *bonne bouche* ; ducks must be driven off if we want fish, and the stately swan must be banished with them. Milbourne, the water-bailiff on the Thames, near London, speaking of swans, gives this graphic description of their doings :—"Lord bless you, sir ! they not only *eat* the spawn, but they eat *nearly all of it*. The number of swans already between Walton and Staines is beyond

* Letters on Chemistry, p. 67.

† We recommend that of M. Jourdiere, already referred to.

belief. They swarm there; and if they're to be allowed to breed, we shall have such a mass of swans that the river will be regularly smothered with them. Suppose they don't know where nor how to find the spawn? Gammon! Don't a donkey know where to look for thistles, and don't I know where beefsteaks grow?"

The water-ouzel has unexpectedly got justice done to him by the solemn verdict of a scientific meeting of the Zoological Society in February 1863. Having been fairly put upon his trial as a notour destroyer of fish-spawn, the first verdict was "Not proven." This being the form of a Scotch verdict, an English water-ouzel was entitled to enter a demurrer. We are therefore not surprised to learn that a distinguished ornithologist objected to it, and that the jury ultimately returned their verdict thus: "Water-ouzel *fully acquitted* of the charge of eating fish-spawn."

The fact is, the water-ouzel frequents the spawning-beds in order to prey upon the insects which feed on the ova of the fish; so that in our merciless ignorance we have been killing a piscicultural friend every time we shot a water-ouzel; just as, we believe, the farmer hangs a friend every time he traps a mole.

As to the feeding of "water-babies," as Mr Buckland affectionately calls his fishlings, they resemble land babies in this, that they are more apt to suffer from too much than from too little food. The favourite fare at Stormontfield is pounded sheep's liver; but in France, pounded fish is much used; and M. Jourdier thus writes of a kind of diet which we commended to public approbation in our article, 'Hippophagy, or should we eat our Horses?' (Journal, October 1851):—"Nothing is easier than to feed young fish with the muscular flesh of the ox, bruised or cut so as to suit the size of the little creatures; and if this be too dear, its place may be supplied by *horse-flesh* cooked or raw, dried and pulverised."

This mention of a kind of food on which fishes thrive induces us to invite our readers to test its value, as we have recently done, in a spirit of philosophical inquiry; and we solemnly declare, without the slightest digestive remorse, though to the horror of our cook, a privileged old servant, who rules the roast, and us too sometimes! Misled by her imagination, and not following her nose assuredly, she declared that she perceived "a fearfu' smell before the stuff cam' near the door." After we had eaten delicious soup and excellent stew, prepared by her reluctant hands, the worthy woman thought she should pray for us. "The Lord be wi' the maister! After eatin' o' sic an onnat'ral brute, he's shure to tak' the worst kind o' jaundice, for it's aye ta'en wi' an awfu' scunner."*

We are happy to announce that the jaundice was all in her eye; and that we are enjoying peace of mind and body after this first, but we hope not last, trial of hippophagy.

* *Anglic!*—intense disgust.

INTRODUCTION OF THE CHINCHONA PLANT INTO INDIA.

EVERYTHING likely to increase the value of land, and in connection therewith open up a new field for the employment of the labouring population, being of interest to the readers of this Journal, it will not be considered out of place in us to devote a few pages to the introduction of the Chinchona plant into India. Our information on the subject is derived from a very interesting Blue-Book which was recently presented to Parliament.

The chinchona, owing to the two active principles of its bark, quinine and chinchonine, is, as is well known, one of the most valuable of all the flora for medicinal purposes. In all cases of intermittent fever, or of diseases accompanied by febrile debility, the use of this bark is attended with the best results. It is now about two centuries and a quarter ago since it was first introduced into Europe by the Peruvian viceroy's wife, the Countess del Chinchon, who had been cured by it of an intermittent fever which had refused to yield to other remedies, and from whom it derives its name. During its early history in Europe, however, the chinchona bark passed under a variety of names. It was called Jesuits' bark, from the circumstance of the missionaries belonging to that body having brought it with them to Rome, where they were successful in curing febrile and nervous diseases by its use; also Cardinal de Lugo's powder, because that ecclesiastic was active in recommending and distributing it; and it was known as China, Quina, and Quinquina bark. Its use, at first, was greatly restricted by religious zeal and prejudice: Protestants refusing to employ it because it was extolled by the Jesuits; and it also suffered in estimation by falling into the hands of empirics. In the course of little more than thirty years after its introduction into Europe it had fallen into disuse, but was again brought into notice by an Englishman, Sir Robert Talbor, who made a secret of its properties, and sold the knowledge of his nostrum for intermittents to Louis XIV. for a handsome sum. Morton and Sydenham were the next English physicians who employed it with great success, making no secret of the prescription; and its use by such men led to its general adoption, though not without opposition from the medical faculty, especially in France.

The chinchona is found only in South America, and chiefly on the eastern slope of the Cordilleras. In 1852 the advisability of introducing it into India, where, from the soil and situation, it was thought likely that it might prosper, was brought under the consideration of Government; but, through the abundance of redtapeism that appertains to Government transactions, it was not until the latter end of 1859 that anybody was sent out to collect the plants that were to form the nucleus of future chinchona forests in India. By this time one or two of those most interested in the project, and

whose advice would have proved very valuable, were dead; and had it not been for the energy and determined perseverance of Mr Clements R. Markham, at that time a clerk in the India Office, it is probable that the whole expedition would have fallen through. And, while ultimately authorising the expedition, the authorities greatly lessened its chance of success by refusing to provide a steamer direct to India with its precious freight, though there were plenty of H.M.'s ships on the coast; and the cases with the plants had to be sent to Southampton, and thence to India. It is therefore greatly to the credit of Mr Markham that he succeeded, under so many disadvantages—the difficulties of collection will be noticed after—in conveying live chinchona plants to India.

In order to avoid failure if possible, Mr Markham, before going out, suggested that there should be four separate expeditions of which he should have the general charge. This seemed to him necessary, the valuable species of the plant being scattered over a space of about 1700 miles. He proposed himself to undertake the labour of collection of the *C. calisaya* and *C. micranthus*, two of the most valuable of the quinine-producing plants in the forests of Bolivia, and Carabaya, a Peruvian province, bringing down the plants for shipment to Islay. To the forests of Huanuco and Huamalies, 250 miles from Lima, which produce two valuable species *C. nitida* and *C. glandulifera*, he proposed to send some competent person who should meet him with his collection at Callao. To the forests of Cuenca and Loxa, in Ecuador, where the varieties *C. chahuarguera*, *C. uritusinga*, and *C. condaminea* are found, another collector was to be sent; and a fourth to obtain the *C. pitaya* and *C. lancifolia* from the forests of New Granada; but, so far as we can find from the Blue-Book, the latter enterprise was not sanctioned—the other three were.

When Mr Markham arrived in South America, he found that the difficulties of his very onerous enterprise would be greatly increased by the feuds between the almost constantly fighting republics of that country. The President of Peru had possession of part of the town and river of Guayaquil; hostilities were just about to commence between Bolivia and Peru; and the natives of both countries had a strong prejudice against, and jealousy of, foreigners, and were particularly opposed to any interference with their stock of chinchona trees, which, through want of cultivation, were rapidly diminishing. While staying at Arequipa, March 1860, Mr Markham appears to have felt keenly the difficulties of the service upon which he was about to enter; and he writes to the Secretary of the Madras Government, expressing a hope that the Secretary of State in Council was aware of the chances of failure. "The forests," he says, "where the chinchona grow are almost inaccessible—without roads or habitations. There is great risk of being disabled by fevers in the humid forests, by 'soroche' (an illness brought on by the

great height) in crossing the Andes, and by dysentery and ague on the coast. The plants, after they are procured, will have to pass on mules' backs over the frozen plains of the Andes and the hot arid deserts on the coast, before reaching the Wardian cases; and then will follow several voyages in different steamers, which will last for three months. The roads from the forests and across the Eastern Cordillera pass along the edges of precipices, and over ridges, where one false step would cause the loss of mules and cargo."

Mr Markham, however, did not allow his despondency to interfere with his activity. While feeling strongly that it was "not in mortals to command success," he resolved so to act as to deserve it.

On March 22, 1860, Mr Markham left Arequipa, not then having fully determined whether to proceed to the forests of Bolivia, where the calisaya tree was undoubtedly most abundant, or to the province of Carabaya, where it was also found, but in less quantity. He arrived at Puno, a city on the banks of Lake Titicaca, on the 27th, the five days' journey being a very painful one over snowy heights at an elevation of 15,500 feet above the sea level. At Puno he found that war between Peru and Bolivia was imminent, a circumstance which led him to direct his steps northward, towards the forests of Carabaya. The journey was even more difficult and dangerous than that from Arequipa to Puno. For economy Mr Markham travelled without a muleteer, and with beasts that could be hired at the cheapest rate, from one village to another, a method entailing great trouble and annoyance. "There were four broad and very rapid rivers to cross on *balsas*, or long bundles of reeds stitched together, while the mules swam. The plains and mountain ranges over which the way passed averaged a height of 12,000 to 13,000 feet above the level of the sea, and one snowy pass attained a height of 17,000 feet. The season was one of violent storms, with hail and snow and constant rains." Yet the distance from Puno to Crucero, the capital of Carabaya, 160 miles, in spite of all obstacles, was accomplished in nine days.

Of the Carabayan valleys, that in which is situated the village of Sandia was the first Mr Markham resolved on exploring. His expedition was of anything but an imposing character; it consisted of the English gardener, "a native lad, and three Indians bearing a tent; provisions consisting of toasted stale bread, salted cheese, maize, and a few other necessaries." From this valley, in which Mr Markham was successful in finding several specimens of the plants of which he was in search, he clambered over to another where the difficulties of collection were greater than any previously encountered. "With the exception of a few small clearings, the whole ravine is covered with one dense tropical forest, without road or path of any kind, and I resolved to penetrate, in the performance of this service, where, as far as I could learn, no European had been before, and no human being for upwards of twelve years, when the bark

trade of Caravaya came to an end. Beyond the river Challuma, a tributary of the Tambopata, and the extreme point reached by Dr Weddell, there is no path of any kind; the trees are of great height, and the ground is entirely choked up with creepers, fallen masses of trees and bushes, and tangled bamboos. In many places the way led along the verge of a precipice overhanging the river, which boiled and surged many hundreds of feet below. Our encampments were made each night on any stony beach we could find, where there was space to light a fire and pitch the tent; and all day we toiled and struggled through the closely-woven jungle." In other places, the adventurous plant-hunter had to trace his way along the most giddy precipices overhanging the river, with no foothold but decaying leaves—nothing to grasp but rotten branches—every motion a drenching bath from the wet branches, and every other step a painful or dangerous slip or fall. Yet, in spite of all these difficulties Mr Markham, in a fortnight after he had left Sandia, had collected sufficient plants of the chinchona to fill the Wardian cases which had been provided for them at Islay. He had obtained, altogether, 529, consisting of—

Chinchona Calisaya, <i>Var. A. Vera</i> of Weddell, . . .	237
Chinchona Calisaya Morada, <i>C. Boliviana</i> of Weddell, . . .	183
Chinchona Calisaya, <i>Var. B. Josephiana</i> of Weddell, . . .	75
Chinchona Calisaya Verde, . . .	2
Chinchona Ovata, <i>Var. A. vulgaris</i> of Weddell, . . .	9
Chinchona Ovata, <i>Var. B. Rufinervis</i> of Weddell, . . .	16
Chinchona Micrantha, <i>C. affinis</i> of Weddell, . . .	7

529

Mr Markham's difficulties did not end with the collection of the plants. Through the ill-natured jealousy of a Peruvian, who stirred up the municipal authorities against him, Mr Markham was nearly losing the fruits of all his arduous labour; and had it not been that he made a speedy exit from Sandia, and made a forced route to Arequipa, along unfrequented ways, his plants would, without doubt, have been taken from him and destroyed. Of the difficulties of his homeward journey the following extract will afford some idea :—

"On the 17th of May I left Sandia, with one Indian, and two mules carrying the plants, and halted under a splendid range of frowning black cliffs, near the summit of the snowy Caravaya range. On the 18th I reached the summit of the range, and commenced the journey over vast grass-covered plains, covered with stiff white frost. After being eleven hours in the saddle, I stopped at an abandoned shepherd's hut, built of loose stones. The plants, well covered with the tent and blankets, were placed by my side during the night, with the thermometer between us, which, at 6 A.M. was at 20 degrees; the days and nights bitterly cold, but very fine, and generally cloudless. On the 19th I was ten hours in the saddle, and passed the night again in an abandoned hut, with the plants beside me, where the minimum of the thermometer was 30 degrees. Two more journeys of similar length, when the

minimum, during the night of the 21st, was 21 degrees, and of the 22d, 16 degrees, brought me to Vilque, where I procured an arriero and mules to convey me to Arequipa. The sufferings, during my six days' journey over the lofty plains from Sandia to Vilque, were very great; the cold was intense, the work I had with the vicious unmanageable mules was a constant source of anxiety, and I had no food whatever beyond a little parched maize."

Thanks to the care with which the plants had been wrapped up, only 73 out of the 529 were destroyed on the dangerous journey across the Cordilleras; and during the 2d and 3d June the remainder were safely planted in the Wardian cases prepared for them at Islay.

On the interesting reports made by Mr Pritchett and Mr Spruce, the two gentlemen engaged by Mr Markham to collect plants and seed in the forests of Huanuco and Ecuador, our space will not permit us to dwell, but we may mention that the report of Mr Spruce is particularly full, scarcely anything in connection with the fauna and flora of the country having missed his observation. Both Mr Pritchett and Mr Spruce were successful in obtaining plants and seeds, though the difficulties interposed in the way of the latter were very great.

On the 27th August 1860 Mr Markham sailed from Southampton for India with the plants he had collected—at least, with such of them as had continued to thrive and exist during their voyage from Peru to England, and during their stay in the latter country—in all 216 that were throwing out shoots, and 53 still retaining life. On his arrival at Alexandria Mr Markham found that 175 plants were still in a vigorous condition, being covered with leaves and green sprouts. The heat of the Red Sea journey, however, and a vexatious detention of six days in Bombay, played havoc with the young plants which had been collected with so much labour and danger, and tended across the inclement Cordilleras with so much care. When they arrived at the Government Gardens at Ootacamund, in the Neilgherries, it was found that the roots of all of them were decayed, and of 207 green-cuttings and 125 wood-cuttings one by one decayed save two. The seeds collected by Mr Pritchett, however, germinated freely in the Neilgherries, at Kew, and in Jamaica; and the plants collected by Mr Spruce, about 600 in number, arrived at Aden in excellent condition, and 463 were in good health when they reached their destination at Ootacamund.

The cultivation of these chinchona plants, and the raising of the seeds, was intrusted entirely to the superintendent of the garden at Ootacamund, Mr M'Ivor, and the Government could not have made a wiser selection. Unfortunately, however, as government authorities are but too apt to do, they allowed an amount of interference with him by two doctors, who, on the strength of a visit to Java, where the Dutch have plantations of chinchona, some of the species of a very worthless sort, dictated conditions that, if acted

on, must have proved fatal to the whole enterprise. As it was, they endangered the success of the undertaking ; and, but for the great interest Mr M'Ivor took in the matter, it is probable that he would have resigned in disgust, and the empirics would have had their way, which could only have ended in ruin.

The grand result of Mr M'Ivor's system of culture, which was sanctioned by all who had observed the growth of the chinchona in its native habitat, is that there were on the Neilgherries, at the end of February this year, no less than 135,739 plants in a healthy condition. Of these, about 49,000 were of the red-bark variety, the bark of which is worth from 2s. 6d. to 8s. 9d. per lb. ; and 51,000 select crown-bark trees, the bark of which ranges from 2s. 10d. to 7s. per lb. in the London market. There is every prospect, therefore, that, ere many years are over, India will not only have saved the £50,000 she was annually in the habit of spending for the extract of this most valuable bark, but that she will derive a large revenue from the export of the commodity. The cultivation will afford work for a considerable number of Europeans, and when the trees have become sufficiently matured for the collection of the bark, a still larger number of hands will be required ; and, unlike most Indian work, it will lie in regions whose climates will be suitable to the English constitution. That private persons will engage in the culture of this plant, and so increase the chances of employment, is sufficiently evident from the fact, that already 34,000 plants have been applied for by twelve persons.

The complete success of this onerous undertaking is only another proof of the indomitable courage, perseverance, activity, and skill of Englishmen.

THE CROSSING OF STOCK.

THE practice of crossing different breeds of stock, for the purpose of uniting, as far as possible, in one class of animals, certain distinguishing and valuable characteristics which previously existed in two distinct classes, has been productive of important changes in the description of stock now reared in many districts, compared with what it was some twenty or thirty years ago, leading to more abundant supplies of animal food for the use of consumers, and, in the case of sheep, to larger supplies and an improved quality of the raw material for manufacturing purposes. It is not, therefore, altogether a farmer's question, although, no doubt, farmers are chiefly interested in it in the first place ; there are others to whom it has proved of great service, and who would suffer serious loss, we may

almost say privations, were it to be abandoned, or even injudiciously followed.

What may be styled our original breeds, possess, for the most part, many valuable properties, particularly in the quality of their meat when fully fattened; but their progress is slow, and it requires several years to bring them to maturity. Other breeds, however, become ripe at an early age, but this precocity is accompanied with a certain degree of inferiority in the quality of the meat, there being generally too much fat in proportion to the lean, and the fat and lean are not mixed in the most economical or pleasant manner for the use of consumers. Hence the union of these properties—the amalgamation in one animal of the quality and early maturity possessed by two other animals—is evidently a matter of great importance. This is precisely what we effect when females of the Highland or polled breeds are put to bulls of the shorthorned breed of cattle, and when females of the blackfaced or Cheviot breeds of sheep are put to males of the Leicester breed; and year after year we find the strongest testimony borne to the superiority of the Scotch crosses over all the other breeds sent to supply the London markets, and especially the Christmas market. Those cross cattle are full of the best points for the butcher, and it is this qualification which places them so high in the estimation of those who supply the higher ranks of society in London, that class of consumers who will have the best quality of meat which can be procured, and who are willing to pay liberally for the gratification of their tastes.

It is not our intention to enter into details merely with the view of proving the advantages which have been derived from crossing. Proof of this kind is unnecessary, because the matter itself has become an established fact. There are, however, some points connected with crossing which we consider of importance, but which sometimes appear to be overlooked or misunderstood, judging at least from certain practices which have frequently come under our observation. To some of these topics we shall now direct our attention.

It is absolutely necessary that the animals selected for crossing shall be pure of their kinds, especially in the case of the male. We have frequently seen people buying inferior shorthorn bulls or Leicester rams for crossing, alleging that such were good enough for the purpose. We decidedly maintain that such animals ought never to be used for crossing—that, in fact, it is just as necessary to have the purest blood in the males selected for crossing purposes, as it is when the object of the breeder is to keep up a pure-bred herd or flock. When a mongrel is used—and a great deal of what are called shorthorns and Leicesters nowadays are nothing but mongrels—we have all their bad properties imparted to their cross-bred progeny, with few, if any, of whatever good qualifications they may possess. And these bad properties may not be apparent in the sire; he may, on

the whole, appear tolerably good, but nevertheless the stain is latent in him, and it will come out. Any one who wishes to be safe, who wishes to succeed in crossing, must use only those sires which are of pure blood, and the best strains which can be procured; for although such may cost more money at the outset, the final results will prove that it has been the wisest course.

But in order that crossing may be completely successful, it is requisite that the females shall also be of a pure and distinct breed. We shall no doubt improve the produce of cross-bred or mongrel cows by putting them to pure shorthorn bulls; but we shall not have an equally good cross in all respects as we would have from cows of a pure and distinct breed. We may, indeed, go on crossing the cross-bred females with pure shorthorn bulls, and with each successive generation we shall find the produce assimilating more and more to the shorthorn; but is this desirable? We cannot make them pure shorthorns, and we have lost, in a great measure, the hardness of constitution, with the disposition to form a valuable and economical class of meat-producing animals, which is so prominent in the first cross. So far from being gainers, therefore, by going on crossing cross-bred females during successive generations, we become actual losers; and it is more profitable, in many respects, that in crossing we adhere to two pure and distinct breeds, using the stock procured by this union for the production of meat, and not for any further propagation of their species.

It is evident, therefore, that as crossing has become an established and important feature in modern farm-practice, it is absolutely necessary that a sufficient supply of females of pure breeds shall be kept up; and it is not only requisite that a sufficient supply shall be maintained, but it is not less needful that the utmost attention shall be given to the permanent improvement of those pure breeds. This, of course, will be best effected by selection; and here we would remark that there is a wide and most remunerative field for the exercise of skill on the part of breeders. We know there are breeders who are most careful in selecting the animals, both male and female, which they intend to breed from—and the stock of such men has a name; but it must be allowed this is not always the case. Take our Highland cattle, for instance, a noble and valuable breed, the females of which produce admirable crosses when put to well-bred shorthorn bulls. That a great deal of Highland cattle are bred without much care being exercised with respect to selecting the best animals to be kept as bulls, or the best heifers to be used as cows, is well known, and may be seen from the droves of inferior cattle which are shown at many of our fairs, particularly droves which have been gathered in the northern part of the Highlands. A considerable proportion of the inferior cattle are bred by small tenants who have not the means of improvement at command; and it ought to be the duty of proprietors in such cases to supply

well-bred Highland bulls for the use of their tenantry, selecting those bulls from herds of known repute, and renewing them when necessary. A better description of heifers should also be introduced wherever the inferior kinds of Highland cattle prevail; and in this manner much good would be done. The cattle reared in those districts would become improved; higher prices would be obtained for them; and those who bought the pure heifers for the purposes of cross-breeding, would have a description of animal much better suited for the object they have in view, than the coarse and otherwise inferior cattle with which they have hitherto been partly supplied.

In like manner, the polled breeds should be preserved in their purity, improved as far as possible without the introduction of any other blood, no matter how valuable that blood might be in other respects, and the breeding of stock of this kind extended in all localities suitable for the purpose. We say this because there are many districts well adapted for rearing our valuable polled and Highland cattle in different parts of the kingdom, but which are occupied at present by cattle of a vastly inferior description, and cattle nominally of an improved kind, but really less suited for those districts than the pure Scotch breeds. Welsh cattle might advantageously give way to the superior Scotch breeds, and in this manner the mountain districts of the Principality would yield a greater revenue to the rearers of cattle, and ultimately to the proprietors of the land. In Ireland, also, there are millions of acres of rough land which are of little value at present, comparatively speaking, but which would be greatly enhanced in value if stocked with Scotch beasts. The cattle bred in such places are of a very inferior description, and hitherto the shorthorn has been chiefly resorted to for the purpose of improvement, wherever any attempts at improvement have been made. But the shorthorn cross does not suit either the climate or the keep of such districts, and hence considerable disappointment has followed the use of shorthorned bulls, especially where insufficient keep has prevented the development of shorthorn characteristics, so that such crosses present even a more stunted appearance than the original cattle of the district; for crosses of the shorthorn breed require generous treatment in food and shelter, in order to render them thoroughly profitable to those who rear them. That the use of bulls of the Scotch breeds would prove generally a better-paying speculation than the shorthorns for breeders on the mountains and other rough tracts in Ireland, to which we refer, does not admit of a doubt, and, in fact, has been proved by experience. Thus Mr Owen, Blesinton, Co. Wicklow, introduced at one time well-bred shorthorn bulls into the mountain parts of the Downshire estates in that part of Ireland which is under his management, with the view of improving the cattle bred by small farmers, to whom the bulls were provided free of all charge. The shorthorn cross, however, did not succeed; neither the climate nor the food which those who reared them

could give suited the cattle, and they were, in fact, a set of ungainly, unthriving runts. Such being the case, the shorthorn bulls were discarded, and polled bulls substituted for them by Mr Owen, the result being crosses which, with great hardiness, fitting them for their mountain home, are also of a much more thriving nature, and greatly in favour with the dealers and graziers who purchase them. But although the cross we allude to has proved satisfactory, we are of opinion that the pure polled breeds—pure in the case of the females as well as the bulls—would be even more beneficial. Were the districts in Ireland which are suited for the breeding of Scotch polled cattle, and cattle of the West Highland breed, together with the Welsh mountain-tracts, to be stocked in this manner, the supply of pure heifers of those valuable breeds, for the purpose of producing crosses with the shorthorn in other and more suitable localities, would be vastly increased; and this we look upon as a question of national importance, considering the deservedly high position which Scotch crosses occupy in the first meat-markets of the kingdom.

Then, again, when we consider the great increase which has been effected in our supplies of meat by the system of crossing the Scotch breeds of sheep—the blackfaced and Cheviot—with Leicester rams, we at once perceive the necessity which exists for keeping up a sufficient supply of pure females of those breeds, and also of endeavouring as far as possible to improve the original native breeds. Those breeds are distinguished for the rich flavour of their close-grained, well-mixed mutton; and a well-cooked ripe blackfaced “gigot” is a dish fit for a king: nor do we think that the Cheviot falls much behind in this respect. But it requires some time to bring sheep of the pure Scotch mountain breeds to perfection for the butcher, and the pressing demands of consumers will not permit breeders to wait in all cases for the tardy ripening of the pure breeds, nor even to trust altogether to the supply of pure-bred sheep. Something which will attain maturity at an earlier age, and at the same time be a valuable description of meat, is demanded, and this is met by crossing the females of the native Scotch breeds with the more precocious Leicester. The Leicester imparts a greater aptitude to fatten; but in its pure state it has the serious defect of too much fat outside and too little tallow inside. The latter depreciating properties are counteracted by those of the Cheviot and blackfaced breeds, and a cross is produced which possesses a large share of the early maturity of the breed to which the sires belonged, but retaining in a great measure the superiority of that from which the dams were derived in point of quality of flesh, combined with greater weights than pure sheep of either the blackfaced or Cheviot breeds usually attain. The wool also undergoes an important change; so that, altogether, crossing of this kind effects very desirable results.

But to keep up the supply of pure sheep of the best description

for crossing, the improvement of the original breeds must be sedulously attended to. We know many consider that any sort of black-faced or Cheviot ewes will suit for crossing with Leicester rams, and those people often buy very inferior animals for that purpose; the real reason of such a preference being, perhaps, that a little money goes a long way in so far as numbers are concerned. Now, we are quite aware that ewes of an inferior description do produce wonderfully good lambs when put to pure-bred Leicester rams—that is, wonderfully good, considering the quality of the ewes; but we maintain that it is much more profitable to purchase a better class of ewes—in fact, the best that can be procured—when crossing is the object, and that the difference in the original prices of the dams will be more than repaid in the superiority of the cross-bred lambs. And we would again insist, that the same principle which we maintain should be observed in the selection of shorthorn bulls for crossing holds good in the case of rams. There are many persons who use cross-bred rams; but this is decidedly wrong: and in practice we hold the opinion, that the worst ram from a pure Leicester flock of established repute is to be preferred to the best out of a flock in which there is a stain.

We shall always continue to have in our mountain-ranges a nursery for sheep of the pure black-faced and Cheviot breeds. The extension of deer-forests has no doubt done much to circumscribe the pasture-grounds, and to cause a material falling-off in the supplies of what are infinitely more valuable commodities to the nation than venison and deerskins. Still, serious as the decline has unquestionably proved, the extent of our mountain-ranges precludes the idea that deer will everywhere take the place of sheep, or the gaitered gamekeeper altogether supersede the grey-plaided shepherd. And, as there is a field in the mountain districts of Ireland and other parts of the kingdom for an extension of the breeding of our valuable Scotch beasts—in like manner, those mountain districts offer a further field for the extension of sheep-farming, as practised so successfully in Scotland, but which is as yet scarcely known in any of its details either in Ireland or in Wales.

The wide difference which exists between a West Linton black-faced sheep and the narrow, crabbed, goatish-looking specimens of the breed which are bred in some parts of the Highlands, shows that there is room for much improvement in the case of the latter. The same distinction is evident in Cheviots; and one can scarcely believe that the strong, symmetrical, and heavily-woolled Sutherland sheep of this breed are in any degree allied to the stunted, bare-skinned, and thriftless brutes which claim kindred to them so far as mere name is concerned. As the draft ewes of both breeds—good, bad, and indifferent—usually pass at last into the hands of those who intend to cross them with Leicesters, it is evident that it would be much to the advantage of such buyers were all the sheep raised as far as possible to an equality with the best. We use the

qualification "as far as possible," because improvement must to a certain extent be regulated by the natural circumstances in which a flock is placed; and it is hopeless to expect that as heavy a style of sheep can be reared on "hard" land as we can rear on soft, deep, grassy pastures. Still the purity of the breed can be secured as well in the one case as the other, and this purity ultimately proves advantageous, for pure-bred sheep reared on hard pastures will improve more when taken to better keep than those which have all along been fed on pastures of a superior nature.

While it is an essential element to success in crossing that we adhere to two pure and distinct breeds, it is also essential that the breeds we select have the property of amalgamating in a satisfactory manner. We have seen the cross between a West Highland bull and a cow of the Channel Islands breed; and a very extraordinary result was produced by that cross, for the head and fore-quarters were those of the sire, while the narrow pins and thin hams were just as unmistakably those of the dam. There was no uniformity, and the animal appeared as if in two distinct pieces, showing clearly that the two breeds which had produced this cross had no affinity for each other. We have seen both Lincoln and Cotswold rams used for crossing, and must say we are not partial to either. It must be remembered that the modern Lincoln is a cross, produced by the use of Leicester rams on the coarse gaunt ewes of the original Lincoln breed; and we suspect that it still requires an occasional infusion of Leicester blood to keep all right in a Lincoln flock. The Leicester has hitherto been employed more than any other breed to furnish rams for crossing, and invariably with success. The Southdown makes also a good cross with the Scotch breeds; but a better cross is produced by the use of Shropshire rams: this cross having the finely-flavoured and well-mixed meat of both breeds—for these qualities are found in great perfection in the Shropshire—with early maturity and heavy weights. The Shropshire was originally a mountain breed, and has been brought to its present state of perfection by careful selection, good feeding, and judicious management. In crossing cattle, the shorthorn male is now generally recognised as the best—and justly so, as it has the property of blending with every breed in such a manner as to effect a decided improvement; at the same time, we have seen excellent crosses produced by the use of Hereford bulls; and in the case of kindred breeds, the infusion of Galloway blood into the Angus has tended materially to benefit the latter.

We have observed, when crossing with pure and distinct breeds, that success was most apparent when young females, which had never previously had progeny, were selected. For example, we have found that Cheviot gimmers, when put to pure Leicester rams, produced a larger proportion of lambs resembling the sire than were produced by an equal number of old ewes of the same

breed. We have observed the same occurring when using heifers and aged cows, say of the Highland breed, with shorthorn bulls. This, we acknowledge, does not hold good in all cases; for there are cows which always throw their calves very much like whatever bull has been used; and this feature we have noticed as characterising, in a marked degree, certain shorthorn cows of very high blood. Still, the point to which we refer does occur often enough to render it necessary that it should be kept in view by breeders.

It would appear that the male which has been first used frequently exercises such an influence on the female as to cause her progeny afterwards, though not got by the same male, to resemble the first. The case of a mare belonging to the late Earl of Morton has been often cited as illustrating this phenomenon. That mare, as many of our readers will doubtless remember, was put to a quagga, producing a foal which was marked with the cross-bars of the sire, and showing proof of his descent in other points; but when the mare was afterwards put to a horse, the result was that the quagga marks were still found in the progeny. Mares which have been first put to an ass have afterwards produced foals having the appearance of mules, although got by horses of a pure breed. We have known a black Angus cow producing a calf which bore every mark of being a cross of the shorthorn, notwithstanding that the sire had been a pure-bred prize Angus bull; but the cow had been put, when a heifer, to a shorthorn bull, and thus she continued to throw calves resembling the first male which had been used with her. This was a marked case, because she was a prize cow, as an Angus; and her owner, being desirous to win with her calves, was most particular in the selection of the Angus bulls to which he sent her. All was of no avail, however, although two different Angus bulls were used in successive years, both jet black, and both of them prize bulls, out of pure herds. A brown farm mare was put to a black draught stallion of the same breed, possessing a fish-shaped white mark in his face. The foal was also black, with the exact counterpart of his sire's somewhat peculiar face-mark. The mare was next served by a beautiful dappled bay horse; but the influence of the first sire was too strong, and the foal was such an exact resemblance of his elder half-brother, both in his general colour and peculiar mark, that it was somewhat difficult to distinguish between them when the two came afterwards to be worked together. Mr Wilson, Cross House, read an interesting paper, at the last winter half-yearly meeting of the Penicuik Agricultural Society, on the management of his farms, in which he alludes to a case which clearly illustrates the point to which we are now referring. Mr Wilson has a black half-bred mare, which had a chestnut foal to a blood-horse of that colour. Next year she was served by a bay cart-horse, and as she is a strong mare, Mr Wilson expected that the result would be a powerful, strong-legged foal;

but the reverse actually happened, the second foal being not only as fine and blood-like as the foal she had by the blood-horse, but it was also a chestnut. Mr Wilson states that, "after being served by the cart-horse, the mare seemed to have a peculiar fancy for a chestnut horse that was frequently put into the stable," evincing great excitement whenever she saw him; and he asks, "Could this fancy for the chestnut horse, and shape and colour of the foal, be the result of the mare's first connection with the chestnut blood-horse; and did his influence reach to the subsequent progeny of the mare in the conception of which he himself had no share?" We think there is little doubt but that the question may be freely answered in the affirmative. Attention has also been called by Dr Alexander Harvey to the fact that, "in several foals, in the royal stud at Hampton Court, got by the horse Actæon, there were unequivocal marks of the horse Colonel, by which the dams of these foals were covered the previous year. Again, a colt, the property of the Earl of Suffield, got by Laurel, so resembled another horse (Camel) that it was whispered—nay, even asserted—at Newmarket, that he must have been got by Camel. It was ascertained, however, that the only relation which the colt bore to Camel was, that the latter had served his mother the previous season." Several cases of a similar nature could easily be adduced; and we have no doubt but that there have also been many unrecorded instances which prove that the male which is first used frequently exercises an influence on the characteristics of the future progeny of the female, although that first sire may never have been again employed. An explanation of this curious fact is given by a writer in the 'North British Agriculturist,' April 8, 1863, in the course of a review of Mr James M'Gillivray's 'Manual of Veterinary Science and Practice.' Alluding to "the resemblance which young animals generally bear, not to their own sire, but to the male with whom the dam may have previously had fruitful intercourse," the writer proceeds to say that "Mr M'Gillivray had his attention directed to the subject early in 1849, and by patient and physiological research arrived at the true explanation, that the *fœtus in utero*, which of course owes a share of its qualities to its sire, inoculates, as it were, the dam by the free circulation of the foetal blood through the maternal system, and thus renders her apt in subsequent pregnancies by different males to impress on the progeny some of the characters thus curiously acquired. This interesting discovery," says the reviewer, "has given Mr M'Gillivray a European name as a physiologist; but the subject, we think, will still bear further investigation. It is just possible that amongst the higher mammalia, as invariably occurs amongst birds, the first access of the male may partially affect the future growth and development of imperfectly developed ova." We certainly consider that an ample field for investigation is afforded, not only in this subject, but in various other phenomena which present

themselves to the notice of the intelligent breeder; at the same time, we cannot go so far as the writer in the 'North British Agriculturist,' and say that young animals "generally bear" a resemblance, "not to their own sire, but to the male with whom the dam may have had previous intercourse." It would have been, perhaps, more correct had "occasionally" been used instead of "generally;" and it would be important to know the reason why the progeny of some females always resemble the male with which they had the first fruitful intercourse, and why the young of other females invariably resemble the male which has been last used. There must be some governing cause to produce such diversities, and it would be both interesting and important to know what is that cause.

There are other circumstances which affect the breeding of animals, and occasionally tend to disturb the expectations which may have been formed with regard to the offspring. That the imagination does act in this manner has been long known, for we find that Jacob availed himself of it in order to increase his own share in his father-in-law's flocks. In like manner it is not unusual when a white bull is used, especially when used to serve white cows, that a pure red animal is placed in full view of the cow during the time she is being served. A worthy friend of ours, who is an eminent breeder of shorthorns, lately used two well-known white bulls in succession with his herd, and as he had during that time very few white calves, he attributes this to his constant observance of the practice we have mentioned. It has been known that cows have produced calves quite unlike the bulls by which they were served, but closely resembling beasts with which the cows had come in contact while in season. It is necessary, therefore, to observe what description of beasts, bullocks or cows, are permitted to jump on and run along with cows in season, particularly where we wish to avoid every chance of the offspring of the latter having anything objectionable in colour, or in any other material point. The writer in the 'North British Agriculturist' whom we have quoted, says he "saw last winter, at Birmingham, a little toy terrier with a very monkey-like face, which the owner, unsolicited, informed me was produced, he thought, by the dam being frequently chained up in a yard, on the wall of which a monkey was generally installed." He adds, that from his "own experience as a breeder of pure white pigs, I am sure that their white colour cannot long be maintained, if black, brown, or spotted sows are allowed to mix with them, even during the short period they require to remain to be hogged." We have known instances which convince us that the writer in question is correct in his opinion, and that the safest and most satisfactory plan in pig-breeding is to keep to one sort, unless there is sufficient accommodation to admit at all times of a distinct and complete separation of the pigs which are of different breeds or of different colours.

There is still another curious fact connected with breeding, which

tends sometimes to puzzle as well as to annoy those who experience it. We allude to the circumstance that animals will exhibit certain properties which they have not inherited from their parents, but from remote ancestors. The fact that pure white ewes, after intercourse with pure white rams, do occasionally produce black lambs, may perhaps be attributed as partly owing to the influence of the imagination; but this will not hold good in all cases, particularly when we find a white ewe always, or nearly so, producing a black lamb; or, out of twins, that one is black. Our attention was directed to this peculiarity some years ago, and we are satisfied that the stain is transmitted from more remote ancestors than the parents. The seventh volume of the 'Transactions of the Highland and Agricultural Society' contains a valuable prize essay on breeding, by Mr Boswell of Balmuto, in which the following illustration of this subject is given:—

"A great many years ago," says Mr Boswell, "the father of the present Sir Alexander Ramsay of Fasque brought a few of the Lancashire cattle to Scotland, a breed then much in fashion, and, as every one knows, remarkable for having uncommonly wide-spreading horns, and all with some white, especially on the back. These cattle were intermixed with the cows of the country; and when Sir Alexander came to his estate the cattle were all horned. About this time the polled or dodded came greatly into vogue in Angus; and Sir Alexander purchased, from time to time, jet-black polled bulls, so that in a short time all his cows were of this sort. Nevertheless, every year, even to this day (1825), one or two of the calves 'cry back' to the Lancashire, having white and horns; and, what is singular, it is almost invariably in the male that this takes place."

It has been known that the majority of the foals got by a dark-bay blood stallion were light chestnuts with white legs, and sometimes white bellies. Yet that same stallion was the fifth generation since that abominable combination of colours had appeared in an ancestress, without being exhibited in any of the intermediate stages.

We have directed attention to the foregoing disturbing influences in breeding, because it is important that we should bear them in mind when engaged either in breeding pure-bred animals, or the most valuable kinds of crosses. And while a knowledge of these facts is important to all who are desirous of preserving the purity of their breeds of stock, leading them to be extremely careful in selecting sires and dams, not only of pure pedigree, but such also as are free from all suspicion of hereditary taint with respect to health—for diseases are assuredly transmissible—and even taint in point of objectionable colour, this knowledge is also requisite in order to show how we are most likely to avoid failures in crossing. It is true that the male usually exercises the greatest influence on the character of the progeny; at the same time, if the dams have inherited anything objectionable, even from remote ancestors, it may and very often does come out in the produce. The crosses with the shorthorn, of cows descended from a mongrel stock, will not

possess the same properties as those of the shorthorns with pure breeds, although there may have been three or four crosses of short-horn blood from the time when the original mongrel stock was first crossed with the shorthorn. Take, for instance, Irish cattle. In the best parts of the country, Irish cattle were at one time of a large and coarse description. These were crossed with the long-horned Leicester breed, and although a certain amount of improvement was thereby effected, a good deal of coarseness remained, accompanied by a degree of slowness in fattening; and these characteristics are still found, notwithstanding successive crosses with bulls of shorthorn blood. Many cross-bred bulls are also evidently used, which does not tend to amend matters; and altogether we find that Irish cattle are low in point of value in the estimation of English feeders and of English butchers. At Norwich, for example, lean Irish beasts sell generally at the rate of 1s. per stone, "when fat," under the prices obtained for "Scots" or shorthorns in similar condition. The quotations in the meat markets also show a discrepancy in value; and thus a recent writer in 'Bell's Messenger' declares, from the character of the imports of Irish stock into England, that "evidently the attempt to cross Irish beasts has been a failure;" and he insists that "the only way to improve the breed in Ireland is to introduce English stock," in which, from the tenor of his previous remarks, he clearly includes Scotch stock — "satisfied," he says, "as we are, that very little can be done with the original Irish breeds." In this opinion we quite agree, and if the coarse-fleshed, big-boned cattle of the midland and western districts afforded an unsuitable foundation for crossing with the shorthorn, matters were even worse in the north and many parts of the south of Ireland, where the cattle were a mixture of different breeds, often of the most incongruous description, and where the universal rule in breeding was, and in many cases still continues to be, to use the cheapest bull which could or can be got, without reference to his qualifications as a sire. It is by no means unusual for two men to lose an entire day's work, even in a busy season, traversing the country with an unfortunate cow in search of a bull whose services might be had for a shilling, because the bull nearest their home would have cost them half-a-crown. It is not to be wondered at that the cattle bred by such people should be of little value, and scarcely paying for their scanty keep. It is the same in the case of Irish sheep, in which we sometimes meet with animals of enormous size; and although somewhat reduced in that respect from what they once were, there still remains a degree of coarseness in the grain of the mutton, especially of aged sheep, which contrasts unfavourably with the finely-flavoured mutton of other breeds. There has been a want of system evinced in the doings of many sheep-breeders in the sister island; and hence there is often a lack of uniformity in the characteristics of sheep exposed for sale at fairs, and even among individual

flocks. In the common sheep of the country we frequently meet with that "sourness" which indicates an animal that does not possess the desirable quality of early maturity; and settlers in Ireland (Scotchmen especially) are often disappointed at first in their expectations of being able to send out Irish cattle and sheep to market fit for the butcher at as early an age as they had been in the habit of doing with crosses of the Scotch breeds of cattle and sheep.

In concluding our remarks, we would therefore briefly say, that as judicious crossing has avowedly done much towards increasing the supplies of meat for the daily wants of an ever-increasing population, it is evident that the best means of keeping up the system is to adhere closely to two pure and distinct breeds, breeding and rearing such in all suitable localities, discouraging further crossing, and avoiding all mongrels, females as well as males. Not only is our population—that is to say, the farmers' customers—increasing, but they are actually consuming more per head than they did at a former period; and they are, besides, demanding a better quality of meat than that which was formerly produced. Inferior qualities can only be sold at even more than proportionably inferior prices; and thus it often occurs that, while the best descriptions of meat experience a quick sale at high rates, coarse descriptions remain in the salesman's hands, or are parted with on very unsatisfactory terms to the owner. And yet, strange to say, those people will continue to breed or buy, year after year, precisely the same description of cattle and sheep, without making a single effort to get into a better class of stock. The success which has attended the practice of crossing, as followed in Scotland, should be an encouragement to others; and we have no hesitation in saying, that a judicious extension of the practice would add materially to the wealth of the nation, as well as contribute to the comfort of individuals. Liebig has told us that "the most urgent problem which the present day has to solve is, the discovery of the means of producing more bread and meat on a given surface, to supply the wants of a continually-increasing population;" and the Scotch system of crossing, we maintain, has done much towards affording the means of solving this all-important problem.

The Existence of Disease among Irish Live Stock.—Very soon after the issue of the last number of this Journal, in which an article on 'Disease among Irish Live Stock' appeared, a strong and unexpected confirmation of the statements contained in that article was given by His Excellency the Lord-Lieutenant of Ireland at the evening meeting of the Royal Dublin Society, held during that Society's last spring show.

It was stated in the article to which we refer, that, of the predisposing causes of disease, "exposure and starvation are undoubtedly the most prominent." Lord Carlisle, who has hitherto been unceasing in his endeavours to show that agricultural affairs are in the happiest possible state in that portion of the kingdom over which he presides as the vice-regal representative of Majesty, felt compelled, on the occasion referred to, to acknowledge that there was something decidedly wrong in the management of those flocks and herds for which he considered Irish soil and climate to be so well adapted. He told his audience that complaints had reached him from Yorkshire (his own country) respecting diseases which have lately prevailed in cattle imported from Ireland, and he read an extract from his Yorkshire correspondent's letter on the subject. It was to the following effect :—

"We have been suffering very severe losses for some time past; I have no doubt not here alone, but throughout the whole neighbourhood, on account of the diseased state of Irish imported cattle. I thought it arose from the treatment they received on ship-board, or being driven about the various markets, which I have no doubt increased the disease; but I am informed, from reliable sources, that the foundation was laid in Ireland, in want of care on the part of breeders in not providing proper shelter for them during the winter season, which no doubt has had something to do with laying the foundation of the disease in question."

The meeting which Lord Carlisle addressed was composed of gentlemen from all parts of the country, who were deeply interested in the subject; and it is to be hoped they will not forget that his Excellency distinctly told them, "it is obvious it must be a damaging and self-punishing process to multiply, to any very great extent, the growth and rearing of flocks and herds without taking care that due provision is made, both for a sufficient quantity of green crops for their food, and shelter against any unusual rigour or severity of climate."

This is precisely the principles which were advocated in the last two numbers of this Journal; and now that the matter is generally understood, our Irish friends may rest assured that their movements henceforth will be eagerly watched by farmers on this side of the Channel; for if their system of management is not speedily amended, they will find Scotch and English farmers refusing to purchase Irish

beasts on any terms, from a dread of disease originating in, and fostered by, the most culpable neglect of ordinary precautions on the part of those who have reared the cattle.

We have observed that a movement was made some time ago to get Professor Gamgee to lecture in Dublin on the diseases of Irish cattle and sheep; but we believe the promoters of that movement failed in securing the encouragement they expected. We do not doubt that some valuable information might have been communicated in a course of lectures; but really, as the case stands, it is not so much a matter for the interposition of the veterinary surgeon, as it is for the agricultural sanitary reformer, and for the agricultural practical improver. Draining the land is much more required than drenching the animals; and abundance of turnips and straw, and a bit of cake, given to beasts comfortably lodged during winter in sheds, yards, or hammels, would be found much cheaper, and infinitely more satisfactory, than all the medicines in the pharmacopœia.

*Insects Injurious to Vegetation.**—One of the most beautiful works we remember to have seen—a perfect specimen of typography and colour-printing, and of clear and accurate drawing and engraving, has lately come over to us from America. Its object is to describe the principal insects by which the crops suffer in the State of Massachusetts, its author, Dr Harris, having been one of the Zoological and Botanical Commissioners appointed by the State to make a survey, “with a view to promote the agricultural benefit of the commonwealth.” It is twenty-two years since the first edition of the book was published; but since that time it has received many additions from its accomplished author; and the present edition comes out under the editorial care of Charles L. Flint, “Secretary of the Massachusetts State Board of Agriculture,” Professor Agassiz having superintended the drawing of the plates. These represent in all nearly 300 different insects, all being of life size, and a large proportion coloured to nature. The total number of distinct insects in Massachusetts alone, Dr Harris estimates to amount to about 4800—a most appalling list surely. On looking over even the number figured in the book before us, and remembering that farmers have many other enemies to war with besides these minute pests, the wonder is that he ever succeeds in getting anything like a respectable crop at all.

There is a delusion which haunts the minds of most men, that farming is an extremely easy and simple occupation—one which

* ‘A Treatise on some of the Insects injurious to Vegetation.’ By Thaddeus William Harris, M.D. A New Edition. Illustrated by Engravings drawn from nature under the supervision of Professor Agassiz. Edited by Charles L. Flint, Secretary of the Massachusetts State Board of Agriculture. Boston: Crosby and Nichols, 117 Washington Street. Trübner & Co., 60 Paternoster Row, London. 1862.

all men think themselves quite able to undertake. Hence we see people who have made a little money as shopkeepers, retired professional men who have had no agricultural experience, and who could hardly tell a plough from a harrow, eagerly competing with and outbidding practical farmers for farms. But profitable farming nowadays really demands an amount of varied knowledge, which should be under the control of practical experience, not called for in any other branch of labour. To know the nature of the soils he tills, requires something of geology; to know the proper manurial ingredients to apply to these soils, demands some knowledge of chemistry. Without some inkling of mechanics, farmers will get on poorly amid the vast array of implements which manufacturers now turn out to facilitate and improve the process of cultivation. Botany is needed to determine the kinds of plants best suited for the climate and the quality of the land; and entomology is required to cope with the hosts of insect life which injure and destroy the blade, leaves, and roots. So far as entomology is concerned, this book will be found a most useful assistant, not only to farmers in the State for which the work was specially prepared, but also to American and European farmers generally, as many of the most destructive kinds of insects figured and described are common to both the old world and the new. If the author had done no more than enabled farmers to identify these insect plagues, he would have done sufficient to entitle him to their gratitude; but he has done a great deal more—he has indicated the natural agencies by which the destroyers may be kept in check. Dr Harris not only gives us a minute description of the grub of the cockchafer, which is so injurious to rich young grasses, often laying waste whole acres,—but he also tells us what means nature has appointed to keep them within due bounds. The badger, the weasel, the bat, the marten, the jay, the crow, and the domestic hen, are all deadly enemies to this terrible foe of the agriculturist; and it follows that indiscriminate killing of these animals must lead to the inordinate increase of the cockchafer. And to kill scores of bushels of them, as was done on a single farm in Norfolk about the end of the last century, will diminish the aggregate, but little if the counter-checks which Nature herself has provided are thoughtlessly destroyed.

The important truth, as it seems to us, to be learned from such a book as this—and it is taught not alone in the case of the cockchafer, but in that of almost all other insects—is the necessity of exercising caution in the destruction of the feathered tribes—the small birds especially. Against an invasion of insects the farmer is almost powerless without the aid of the birds, which he should in general regard more as allies than as enemies. We say in general, because it might occasionally be prudent and desirable to thin the ranks even of the sparrows; but this must not be done after the fashion of the French or the members of Sussex Sparrow Clubs, unless the

destroyers are prepared for a worse thing befalling them than the trifling pilferings of small birds. *Reduction* may possibly become imperative in some places, *extermination* must be followed by ruinous consequences in all. Another lesson the book teaches is, that wisdom may dictate the sparing at times of even destructive insects, so that these may harass and destroy others of a much more injurious character. Thus it would at times conduce to the interest of the gardener to protect the dragon-fly in order that it might keep in check the ravaging rosechafer; and certain mites and worms prey upon the exterminating locust—a fact which it is well that farmers should know. It is not always desirable to get rid of one evil, because, in accomplishing this, we may help to bring down another and a greater ill upon us; and to be able to guard against this casting out one devil and bringing in seven, farmers should study such works as the admirable one of Dr Harris.

It would be impossible to give a summary of a book which itself condenses into the briefest possible space the descriptions of the insects which are injurious to vegetation. All that we can say is, that much that is new and interesting to entomologists about American insects will be found in its pages, and that the chapters on weevils and grain-moths, locusts, &c., are particularly attractive. Of one insect that committed dreadful ravages in America during 1861 it may be well to copy the description, so that if it does visit this country, as many American insects have done to our great loss, farmers may be prepared for it:—

“The army-worm is the larva of a night-flying moth, *Leucania unipuncta*, Haworth (synonymes *L. extranea*, Guénee; *L. impuncta*, Stephens). The IMAGO ‘is very plain and unadorned in its appearance. The eye, on first glancing at it, only recognises it as an ordinary-looking moth of a tarnished yellowish drab-colour, inclining to russet. Nearly in the centre of the wing is a milk-white dot placed upon the mid-vein. This dot is surrounded more or less by a dusky cloud, and this duskiness is frequently extended forward upon the mid-vein to its base, forming a faint darker streak along the middle of the wing. Contiguous to this dot on its outer side may be discerned a roundish spot of a slightly paler yellow colour than the ground, and a very short distance forward of this is a similar spot, but smaller, both these spots often showing a more tarnished centre. On the hind part of the wing the veins are marked by slender whitish lines, and between their tips on the hind edge of the wing is a row of minute black dots. The hind wings are smoky brown, with a purplish gloss, and are nearly transparent, with the veins blackish. The fringe of both pairs of wings is pale yellowish, with a dusky band on the middle. On the under side the wings are much more glossy and paler, opalescent whitish inwardly, and smoky grey towards their outer and hind sides, where they are also freckled with blackish atoms. The smoky colour on the hind wings has on its anterior edge a row of short blackish lines, one on each of the veins, and in a line with them on the fore wings is a faint dusky band, becoming more distinct toward its outer end, or sometimes only represented by a dusky dot on the outer margin forward of the tips. The veins are whitish, and also the hind edge, on which is a row of black dots placed between the tips of the veins. The hind wings have also a blackish crescent-shaped spot a little

forward of their centre. The abdomen or hind body is smoky grey above, and on its under side ash-grey, freckled with black scales, and usually showing a row of black dots along each side.'

"The LARVA, or 'army-worm,' varies considerably in colour and size, owing to age and locality, but its characteristic markings are so constant as to make it readily distinguished. As it appeared in New Hampshire and Massachusetts, it varied in length from less than one inch to one and three quarters, was of a dark grey, with three narrow yellowish stripes above, and a broader one of the same colour or slightly darker on each side, thinly clothed with short hairs, which were longer and somewhat thicker on and about the head, the latter of a polished honey-yellow, with a network of fine dark brown lines, and a black line on the front like the letter V reversed."

Kohl-rabi has been long in use. It is figured in Gerarde's rare and valuable Herbal; and an essay is devoted to it in an excellent old work, the 'Complete Farmer,' published in Dublin in 1777.

It is spoken of very favourably by eminent agriculturists of our own time. Before the London Farmers' Club, and in the 'Journal of the Royal Agricultural Society of England,'* Mr William Bennett, of Cambridge, warmly advocates an extension of the area under the crop. Mr Pawlett, the well-known sheep-breeder, has also recommended it. The late Mr Harkness also read a paper on the subject, before the Royal Agricultural Society of Ireland, a few years ago; and Mr Wilson, Professor of Agriculture in the University of Edinburgh, with all this and other evidence before him, strongly urges its advantages in his work on 'Farm Crops.' After quoting several respectable authorities who are in favour of the crop, such as Hewitt Davis, Mr Bennett, and others, Mr Wilson observes that, "when carefully stored, it will keep good equally as well, and as long, as either swedes, mangold, or carrots; and whether in the field for sheep, in the yards for cattle, or in the stables for the horses, it will generally be preferred to the other descriptions of home-grown keep."

Our experience does not coincide with this statement. *Kohl-rabi* is no doubt good food for sheep, but we find it is too hard-fleshed for old ewes. It is not equal to carrots in the "stables for horses;" and the result of experiments to which we are now about to direct attention, go to prove that, "for cattle in the stalls," it is not equal to swedes.

None of the statements made in favour of *kohl-rabi* having been supported by any comparative trial, the officers of the Glasnevin Institution very properly determined on instituting an experiment to test the fattening properties of the root. The experiment appears to have been conducted with much care and attention, and its results have attracted a good deal of attention.

On the evening of the 2d January 1863, four animals were selected for the experiment, and placed by themselves in a comfortable stall, and divided into two lots—viz. :

* Vol. xviii.

Nos. 1 and 2, making up Lot I., fed on kohl-rabi, oil-cake, and hay.

Nos. 3 and 4, making up Lot II., fed on swedish turnips, oil-cake, and hay.

As the animals fed on kohl-rabi did not relish it, and as it was desirable to allow for the change which a change of food may produce in the system, the experiment did not really commence till the 12th January. And as the animals weighed on that day,

			cwt.	st.				cwt.	st.
Lot I.	No. 1	:	10	1	Lot II.	No. 3	:	7	5
	No. 2	:	7	4		No. 4	:	10	2

they matched well in pairs, so far as weight is concerned; and Mr Baldwin, who conducted the experiment, reports that in every respect Nos. 1 and 4 made a capital match, and so did Nos. 2 and 3. From the 12th to the 25th of January, they received the following kinds and quantities of feeding daily:—

			No. 1.	No. 2	No. 3.	No. 4.
Roots,	.	stones,	7½	6	6	7½
Oil-cake,	.	lb.,	4½	3	3	4½
Hay,	.	lb.,	10½	10½	10½	10½

“The roots,” says Mr Baldwin, “were given in three feeds—viz., at half-past six o’clock A.M., twelve noon, and half-past six P.M. These hours were adopted at first, because Nos. 1 and 4 were fed at the same times before the experiment. From the commencement, Nos. 1 and 2 showed an unwillingness to eat the kohl-rabi; but as it was presented to them in as clean a state as possible, they managed to eat each feed of it before the subsequent feed of cake.”

On the morning of the 25th January the following table of feeding was adopted:—

		No. 1.	No. 2	No. 3.	No. 4.
At 6.30 A.M.,	Roots, stones,	3	2½	2½	3
	Cake, lb.,	1½	1	1	1½
At 12.30 P.M.,	Roots, stones,	3	2½	2½	3
	Cake, lb.,	1½	1	1	1½
At 6.30 P.M.,	Roots, stones,	3	2½	2½	3
	Cake, lb.,	1½	1	1	1½
At 9.30 P.M.,	Hay, lb.,	7	7	7	7

In this way the cattle ate the kohl-rabi somewhat more quickly than before.

On the evening of the 11th February, and at the same hour as on the 12th January, the cattle were again put upon the weighing-machine. The increase in live weight in each beast and lot is shown in the following table:—

No.		Weight on 12th Jan.		Weight on 11th Feb.		Increase in 30 days.
		cwt.	st.	cwt.	st.	
1.	{ Lot I., fed on Kohl Rabi, &c., }	10	1	10	4	3
2.		7	4	7	6	2
						—
3.	{ Lot II., fed on Swedes, &c., }	7	5	8	3	Total, 5
4.		10	2	10	7½	6
						5½
						—
						Total, 11½

It thus appears that the animals fed on swedish turnips, oil-cake, and hay, increased in live weight more than twice as much as the lot fed on the same quantities of khol-rabi, oil-cake, and hay. "This experiment and my previous observations," says Mr Baldwin, "leave little doubt on my mind that swedish turnips are, weight for weight, better for stall-feeding than kohl-rabi."

AGRICULTURAL SUMMARY FOR THE QUARTER.

THERE is as yet every prospect that the present year's harvest will in some degree compensate the farmer for the losses he sustained last. The seed in general obtained an excellent bed at an earlier season of the year than ordinary, though the ground, save in the west, where there was just too much rain, required, owing to the drought, more working than usual. The temperature during the spring was remarkably equable, never rising very high, nor sinking very low. Under such conditions the cereals continued to grow vigorously until about a month or so ago, when it became evident that they needed more rain; and pastures were also kept back for want of moisture. The preparation for the green crop in some districts was rendered very difficult on account of the dryness of the soil; and on stiff soil especially the ground was not reduced to so fine a mould as could have been desired. On heavy carse-lands the want of rain was much felt; and had it not come about a fortnight or three weeks ago, the crops would undoubtedly have suffered. As it is, mangold and turnips on such soils have been hurt. The wet, muggy weather of the spring of 1862 was exceedingly favourable to the growth of the hay crop—the one good crop of the year. The dry weather of the present spring has made a light crop of hay inevitable; but farmers can better afford a short hay crop than a failure in all the other crops of the farm.

The cereals in general are all looking well; autumn wheat being

particularly strong and healthy. In many places it has been in ear for nearly a fortnight, and gives promise of a full crop, both as to ear and straw. The spring wheat is a little more checkered, owing to the difficulties on stiff land of securing a perfect tilth, and in many fields in all districts of the country it is almost entirely choked by that most annoying weed wild mustard, the growth of which seems to have been induced by the dry weather, and the somewhat rougher mould than usual. Barley and oats are in general looking vigorous, and are a full crop, on all free soils especially; and if these plants get the requisite amount of sun, they can hardly fail to prove at harvest of excellent quality, and more than an average quantity. Turnips in some places, *i.e.* on heavy soils, have not been brairding so regularly as could be desired, and several fields have had to be ploughed over, but on all good turnip soils the crop is very promising. In all districts potatoes are looking well, and in the localities where the cultivation of the tuber is paid most attention to, it is long since, in the most forward fields, the leaves were meeting in the drills. Beans are looking healthy, but seemingly not so thick and tall a crop as usual, though the forcing weather of the last three weeks improved them much. We have now, however, had about enough of rain—what we want most is sun. That most annoying and unget-at-able enemy of the farmer, the grub, has been committing great ravages in the north this year again, and many fields have had to be ploughed over.

The grain markets since our last have been generally in a depressed state—altogether discouraging to the arable farmer. Stock have, on the whole, been paying well, and the sheep-farmer, though sustaining pretty severe losses in the Highlands, has had compensation in the high price of wool.

Farmers' Societies, Clubs, &c.—The Agricultural Societies have been very busy, in the interval which has elapsed since the publication of our last Summary, in discussing questions bearing upon the interests of agriculture. Many of these meetings have been of an extremely interesting character, and some of the papers read have been distinguished by high scientific knowledge, as well as by great practical experience. It is difficult to imagine anything better calculated to promote thorough and economical farming than the dissemination of such lectures and discussions. We are well aware that there is still a class of farmers—but we rejoice to think that it is growing smaller and smaller yearly—which affect to despise all agricultural clubs where speaking, and not eating and drinking, is the principal entertainment. They cannot tolerate “book-farmers,” as they sneeringly call those who put their ideas into an intelligible shape, with a view to communicate them to others; and they cling to the belief, that a man who takes to assigning reasons on paper for his practice, is a man whose fields are dirtier, and his farm generally more untidy and less economically managed, than his neighbours’. More than

once we have endeavoured to show that this opinion is as unworthy as it is erroneous, and that complete excellence is only to be attained, and *can* only be attained, by the intercommunication of ideas, and the interchange of the details of everyday farm-work. Much that has been spoken at these meetings during the quarter is, in our opinion, of a character to further the progress of agricultural science and practice, to render empiricism in farming less common, and to increase the estimate in which the profession—the oldest in the world—is held by the general public.

Among the most important papers read, was one by Mr J. B. Spearing of Moultsford, before the *Central Farmers' Club*, London, on *The Effect of Temperature on Cultivation*—a paper noticeable alike for its science, its acuteness of observation, and its practical utility. Mr Spearing started with an idea that had truth as well as novelty (for it is new, so far as we remember)—viz., that the law which governs the bursting of the buds and the growth of the vegetation in spring, is not determined by time, but by heat or temperature. When we say that this idea is novel, we mean that it is so in so far as it relates to what may be called the practical and scientific discussion of temperature; but the poet long ago held very similar ideas to this practical farmer, as we may learn from the verses on 'Spring,' beginning—

"I am coming, little maiden,
With the *pleasant sunshine* laden."

Mr Buchan, Secretary of the Scottish Meteorological Society, in a paper to which we have previously referred, expressed an opinion that wheat could be grown with a mean summer temperature of 58.6°. Mr Spearing's observations would seem to lead to the conclusion, that a higher temperature was needed for a full crop of good quality. He says:—"In the summer of 1860, the temperature of the soil [a foot deep] reached 64 degrees in the valley of the Thames. This being a very early district, our wheat ripened well, and we had a fair average crop of good quality; but I went over much land where the temperature never reached 62 degrees: here the wheat was by no means good, either in quantity or quality; and there was a great deal of strong land in high and cold situations, where the temperature of the soil never reached 60 degrees, and it is needless to say that here the wheat was miserably bad; and it cannot be said that it ever ripened at all, for when cut in a withered state it was still green." From these facts Mr Spearing obtains an argument for deep drainage on cold lands—an operation which, as is well known, raises the temperature of the soil considerably. Still carrying out his idea, that heat, and not days, governs the laws of growth, Mr Spearing proceeds to consider the best time for planting the wheat crop. The deduction he draws from his own observations is, that it is unadvisable to sow wheat until the tem-

perature of the soil has fallen as low as 50 degrees; and, so far as he has noticed, this seldom occurs before the middle of October on cold soils, while, in warm soils, it is generally a fortnight later. The reason for desiring that the temperature should be so low is that, "if wheat is sown before the temperature is sufficiently reduced, it does not remain long enough in the ground to take good root; and I have seldom seen a good crop of wheat grow from seed that came up in less than thirty days." Wheat, sown when the temperature is too high, has to war for possession of the soil with weeds that would not vegetate at a later period; and the wheat-plant is also apt to become too gay or winter-proud, and is therefore less able to resist the inclemency of the winter season than it would have been, had its planting been delayed until the temperature was less forcing. The author of this admirable paper next gives his observations with regard to the length of time and degrees of heat required for the growth and ripening of the wheat plant, which are so important and interesting that it is desirable to quote them entire:—

The plant commences its growth in the spring as soon as the temperature of the soil reaches 43° or 44°. In 1860, I first perceived the wheat begin to grow on the 28th March, when the temperature of the soil was 44°. It was 145 days to the 20th August before it was ripe, from which we must deduct twelve days when the temperature was below 42° (when wheat cannot grow or progress; this leaves 133 days for it to mature in.) In 1861, I noticed the wheat begin to grow on the 24th March, when the temperature was 43°, and it was 130 days to the 2d August before it was ripe. The temperature was not once below 42°, so that there was no deduction to be made from the 130 days. In 1862, the temperature of the soil reached 43° on the 11th, 12th, and 13th January. It then receded for seventeen days, after which it gradually increased for five days, reaching 46° on the 4th February. It ranged from 39° to 46° again up to the 11th March; so that the wheat was constantly growing above ground the whole of the spring, consequently it did not take good or deep root in the soil, and was not likely to produce a heavy or even an average crop. The weather in March is of the utmost, or I may say vital, importance to the wheat plant. As the land becomes dry in March, the roots keep penetrating deeper and deeper into the soil to obtain moisture, and by so doing ample provision is made for the plant to extract that nourishment and support which is necessary for its future well-being and development; but, on the contrary, if we have much wet in March, accompanied, as it generally is, by a high temperature, then the plants grow above ground, and the roots, being supplied with moisture on the surface, are not induced to penetrate sufficiently into the soil so as to be able at the required time to draw that amount of nourishment from the land which alone can enable it to produce a heavy crop. Nor would it be able to do so if the summer afterwards should prove to be more than usually dry and propitious. The amount of rainfall for March 1861 was 2.06 inches; for March 1862 was 4.29; and for March 1863 only 0.63 inches. The next critical period through which wheat has to pass is from the time of its coming into ear to the time when the blossom is fully set. At this time the temperature of the air is of more importance than at any other stage of its growth. Extreme heat is not desirable, but a medium temperature, with the least possible daily range; for I have never observed red gum, rust, or mildew to any extent unless there had been a

difference of from 32° to 35° between the mean maximum or heat of the day and the mean minimum or cold at night; and it prevails to a greater or less degree just in proportion as the range of temperature increases or diminishes. I have known wheat to vary from 49 to 70 days from the time of its coming into ear to the time it was ready for the sickle, according to the amount of heat, as it requires 3000° to 3500° to mature it. In 1860, the wheat which came into ear on the 12th June took 69 days to ripen, and 4191° of heat, from which we must deduct 562° for 10 days when the temperature was below 58° ; this leaves 3629° for the 59 days, at an average of $61\frac{1}{2}^{\circ}$. The greatest heat the soil reached this season was 64° on the 14th and 15th July, after which time the earth gradually lost its heat. In 1861, wheat which came into ear on the 5th June took 55 days to ripen, and 3506° of heat, from which deduct 281° for five days when the temperature was below 58° . This leaves 3225° for 50 days, at an average of $64\frac{1}{2}^{\circ}$. The greatest heat the soil reached this year was 67° on the 20th June, and on the 13th and 14th of August. In 1862, wheat which came into ear on the 9th June took 3406° of heat, and 56 days at an average of 61° . The highest temperature of the soil was 64° on the 30th July, where it remained for seven days. It only reached 64° once more this year—viz., on 29th August.

As relating to the cultivation of barley, the remarks of Mr Spearing are equally useful. He recommends that barley in general should be sown before the temperature has reached any high degree of heat, as, when the temperature is low, the seed remains in the ground sufficiently long to take good root in the soil, and is so enabled to extract plenty of nourishment for a heavy crop; whereas, that which is sown when the ground-temperature is higher, shoots up too soon to have laid a proper foundation for a productive crop, unless, indeed, the late-sown meets with an after-check, such as cold weather at the latter end of May or beginning of June, in which case it may turn out well. Barley, sown when the temperature is low, actually derives far more heat from the ground, because of the longer time it remains in it than that committed to the earth when the temperature is higher. Take one of the many instances which Mr Spearing's observations supply: "In 1860, barley drilled on the 3d April came up on the 23d, remaining 19 days in the ground, and took 802 degrees of heat, at a daily average of 42 degrees; whereas, that which was drilled on the 24th April came up on the 5th May, lying 10 days in the ground, and took only 500 degrees of heat, at an average of 50 degrees." Keeping this fact in view, Mr Spearing thinks "it is a great mistake to leave the roots on the best and highest-conditioned land to seed off last, as in the generality of seasons such land produces three or four sacks of barley less per acre than it would if sown earlier; whereas, the poorer land will almost invariably grow as much sown late as it would if sown forward, and should it not, the difference will never be more than one or two sacks per acre, from the fact of its having longer time to develop by not being forced to maturity so quickly." It is quite easy to see the force of Mr Spearing's reasoning. As the poor land has not got that nourishment to supply to the full extent to which the plant could take it up, it is of less consequence that the plant should remain long in

the ground. When the ground has attained from 40 to 46 degrees of temperature would appear to be the best for barley sowing. On the cultivation of Swedish turnips Mr Spearing has also some valuable remarks. He is of opinion that their mode of cultivation should be determined by the purpose for which they are intended. If they are for storing, Mr Spearing thinks that the ordinary method of drilling the manure on the ridge and depositing the seed immediately above it is best. The plants have not then their food far to seek, and are forced, when singled, to the earliest and greatest maturity. But if the roots are intended to be consumed off the land, this is not the best method, as the forcing so debilitates the root that it cannot stand frost. Mr Spearing recommends, when the roots are intended for the latter purpose, that the land should be previously got into good condition by farmyard or artificial manure before the seed is planted, and, previous to the last ploughing, that a very small portion of artificial manure should be drilled with the seed, so as to start the plants to bring them to the hoe. "They will then have to work for their own good, and in so doing will fulfil the law of nature, and throw out sufficient roots to enable them to stand almost any degree of frost they are likely to be subjected to." From the brief and imperfect summary of this paper which we have been able to give, farmers will see that it is one of a very high character indeed. In connection with this paper farmers may read, with great advantage, *Observations on Underground Temperature*, by Mr Buchan, in the April Report of the Scottish Meteorological Society.

The *Central Farmers' Club* has also been discussing once more the subject of *steam cultivation*, introduced, in a very effective paper, by Mr Morton, editor of the 'Agricultural Gazette.' There can be no doubt that the desirability of using steam instead of horse-power for tillage operations is gradually taking possession of the minds of most farmers, and before many years are over we may hope to see the steam-tackle on most farms to which it is adapted. The question of expense is no doubt the great drawback against its employment, but a way to make the purchase as easy as possible has been opened up to farmers. A company has just been formed in London, under the name of the 'General Steam Cultivation Company,' including many eminent names in the agricultural world, which proposes to supply steam-cultivating machinery (by any maker the farmer may choose), and take payment therefor in instalments extending over a series of years. By this means the purchase-money will be comparatively little missed. And those farmers who have some hesitancy about the value of the steam-plough, and yet have a desire to prove it on their own farms, may do so through the agency of this company, which will supply steam-tackle to them on loan for payment of a certain sum. As an indication of how much interest is now being taken in this subject, it may be

mentioned that it was discussed during the quarter at the *Oxford and Wigton Farmers' Clubs*, as well as at one or two others in the north of England, and at one of the weekly meetings of the *Royal Agricultural Society of England*, as noted immediately below.

The *Central Farmers' Club* had also before it the subject of *Land Drainage*, a matter of which there is a great deal of difference of opinion. Some maintain that comparatively shallow drains—that is, drains from $2\frac{1}{2}$ to 3 feet—are, when placed comparatively near one another, more effective in drawing water from heavy soils than 4-foot drains farther apart; while others hold that it is scarcely possible to go too deep, and that the space between the drains ought to be far wider than the shallow-drain theorists admit. Both these opinions found warm enunciators in the London Club, but the advocates of the 4-foot deep drains preponderated.

At the *Dorchester Farmers' Club* there was a semi-scientific discussion on *Liebig's Mineral Theory*, which of itself shows how much farming has advanced within the last twenty or thirty years. The same Club had also before it a more immediately practical topic—viz. the *Relative Advantages of Fattening Sheep, Cattle, or Pigs, on Light-Land Farms*. The subject was introduced by Mr Chapman Saunders, who expressed his belief that sheep were the most profitable where the soil was light, chiefly because they saved the expense of cartage of roots to the house, which was necessary in the case of bullocks, and benefited the land at certain seasons by treading it down. In this opinion Mr Saunders was supported by almost every member of the Club who spoke in the discussion. At the same time Mr Saunders held that it might be best to keep a mixed stock.

The *Royal Agricultural Society of England* has had, during the quarter, some more than usually interesting lectures delivered at its weekly meetings. Among the papers read was one on *Labourers' Dwellings*, an important subject, treated architecturally rather than socially and morally; another on the *Effect of Underdrainage on the Rivers and Arterial Channels of the Country*, in which, in particular, sufficient outfall for drains in free soils was particularly insisted upon. Professor Voelcker, at one of the meetings, read a paper on the *Adulteration of Linseed Cake*, which had reached such a pitch that even the adulterators are ashamed of their practices, and have made a compact not to put more than 4 per cent of other ingredients into the cake after the 1st of January next. Until that time farmers must needs content themselves with cake adulterated with foreign impurities to the extent of from 12 to 70 per cent. The impurities existing in linseed sold in the markets, Professor Voelcker found on examination to be as follows:—“In Bombay linseed, $4\frac{1}{2}$ per cent; in a sample of fine quality, $1\frac{3}{4}$ per cent; in Black Sea linseed, 20 per cent; in a second sample 12 per cent; in Odessa linseed, $12\frac{1}{2}$ per cent; in medium Riga seed, 35

per cent ; in Merzhanski linseed, 7 per cent ; in fine Black Sea linseed, imported in 1861 and 1862, and considered of good average quality, 19 per cent ; in fine Petersburg, 3 per cent ; in the common Petersburg Rigelf linseed, 41 per cent ; second quality, 43½ per cent ; and in the average quality of Riga crushing linseed the impurities were no less than 45½ per cent. In another specimen of the common Riga linseed, imported in 1862, the impurities amounted to 42 per cent, consisting of 22 per cent of Spurry (*Specula arvensis*), 3 per cent of *Lolium temulentum* (Darnel), 3 per cent of Dodder (*Carmelina*), 2 per cent of Knot Grass (*Polygonus aviculare*), 1 per cent of Chenorodium, and 11 per cent of mustard and other seeds ; and above all, he found that, in the common Petersburg Rigelf linseed, a large portion of which found its way to Hull and other ports, the impurities actually amounted to no less than 70 per cent, while even that which came from Archangel was adulterated to the extent of 34 per cent."

In one particular sample Professor Voelcker found no less than 29 different kinds of weeds, several of them not only innutritious but actually poisonous to animals, so reckless are those dealers in feeding substances ; and several of the weeds, though not injurious to health, spoil the quality of the meat. Things, however, having in this matter of linseed adulteration got to the worst now, they are, in accordance with the old proverb, "sure to mend." This is comforting, but we should advise farmers to use the precaution of always dealing with well-known and respectable firms, and never be anxious to purchase cake at a very low price—such cake, even after the reformation of January 1, 1864, is not likely to prove the most profitable. At this Society, also, Professor Simmonds read a paper on the *Natural History of Parasites in Animals*, but we cannot say that it was calculated to be of much advantage to farmers ; and Mr Ruck gave his own experience with the *Steam Plough*, which has extended over four years, long enough to justify him in expressing an emphatic opinion about the matter. That opinion is decidedly favourable to the steam-driven implement. It has enabled Mr Ruck to dispense with fourteen team of oxen, and he manages to get his tillage operations performed in a much more efficient manner by steam than they were ever done by horse or ox-power. He finds also that the steam-horse, with all its superiority over the horse of flesh and muscle, is a great deal cheaper, costing him, after allowing 12s. per day for wear and tear of engine and tackle, which seems a very liberal allowance, only 5s. per acre. With the plough he can accomplish eight acres per day, and with the scarifier as much as sixteen acres, the price of the latter operation being thus only 2s. 6d. per acre. These costs are just about a third of the price Mr Ruck paid for having less effectual work done by oxen ; and the injurious treading of the hoofs is obviated. Great advantage, according to Mr Ruck, also results to drainage

from the application of the steam-plough and cultivator. He mentioned the case of a piece of land, a particularly tenacious Oxford clay, "which had been drained fourteen years, and had lain quite wet under horse and oxen culture ; but since it has been cultivated by steam, I have never seen a drop of water on its surface, though no alteration has been made on the drains, which are now just what they were fourteen years ago." Mr Ruck is of opinion that the use of the steam-plough will increase the value of land about one-third, which, if true, should be a sufficient inducement to landlords to encourage enterprising tenants, by the removal of stones and fences, &c., to enter upon steam-cultivation. On light land Mr Ruck believes the steam-plough will be especially beneficial, as on such land "by one operation they would entirely change the nature of the soil. They prevented its burning or frying up, and a great quantity of land would, by the use of steam, be rendered capable of growing beans, for which it was now altogether unsuited." The lecturer also pointed out, that the use of steam apparatus enabled farmers to get their work done at the proper season, that it did away with ridge-and-furrow, did away with difficulties in horse-hoeing, and left the land in a state much easier for the operations of the reaping and mowing machine. Further, Mr Ruck stated his belief, that by the employment of the steam-plough "summer fallow would be entirely extinguished. Again, rolling would not be required any more than it was required under spade husbandry, and the increase of crops he placed at one quarter to the acre. The increase of stock also must be very great. In the autumn they ploughed their land and planted it with vetches or rye at one operation, which in the spring of the year they fed off before they came on with their root crops ; consequently their flock of sheep would be greatly enlarged. Their root crop would be of much greater weight and of better quality, and the land in a much better state for the sheep to be on, being drier and more healthy for the animals than when it had been horse-ploughed. And as to malting barley, whenever he had sold any he had always had the maltster sending to him again for more, finding that the steam-ploughed barley was superior to the horse-ploughed for malting purposes. The crops of seeds they would find to be wonderfully better in consequence of the extra depth of cultivation. Clover that would hardly stand more than once in five or six years with horse culture, they would have no difficulty in growing every three or four years with steam."

This paper, coming as it did from an eminently practical and successful farmer, ought to carry conviction with it as to the utility and the profitableness of the steam apparatus. Professor Coleman delivered before the *Society* a very sensible and interesting paper on the breeding and feeding of sheep, in which he recommended that greater quantities of straw should be given, and a less quantity of

turnips. The straw, we were somewhat surprised to hear him say, should be given in an uncut form—an opinion not in accordance with that generally entertained; as it is found that neither bullocks nor sheep will eat so much of that material when it is uncut as to make any very appreciable reduction in the quantity of turnips they consume. All who have tried the pulping and chaff-cutting systems are agreed that a vast saving is effected in the roots, by having them mixed with the cut straw, while both bullocks and sheep fatten quicker, and are healthier on this mixture than when they are fed on uncut straw, and have the roots unpulped. The management recommended in the paper was of a kind only suited to certain districts, but for farmers in such districts the advice was valuable.

The *Buchan Agricultural Association* had before it, in a somewhat informal way, the subject of *Finger-and-Toe in Turnip*, which the chief speaker, Mr Murray, Nethermills, considered to be due to poison in the soil, as all his efforts with a very powerful microscope had failed to detect the presence of an insect in any of the diseased roots. He mentioned that he had tried drilling the turnip field nearly a fortnight before manuring it, and this had proved an effectual preventive of the disease, both with himself and a neighbour—portions of the fields which had been treated in the usual way being badly affected.

The *Inverness Farmers' Society* had a discussion as to whether sheep or cattle were more profitable on an arable farm; but the general conclusion appears to have been that both were best.

The *Nairnshire Farming Society* had a discussion as to whether thick or thin sowing, or sowing by hand or machine, were best; but the opinions expressed were so various and conflicting that not much good could result from the debate.

The *Teviotdale Farmers' Club* has had before it the advantages and disadvantages of heather-burning as regards game and sheep; and the general opinion come to, and we believe it was a correct one, was, that the judicious burning of heather is advantageous both to sheep and grouse, both of which are fond of the young heather which springs up the autumn after the old has been burned. Among other Clubs holding meetings during the quarter, may be mentioned the *Galashiels*, which discussed the question of the *Game Laws*, concerning which they had little to complain—the landlords in that district keeping the game in such a state of subjection, that the crops were little injured by it. The *Borough Bridge Agricultural Society*, which had under its consideration the breeding and management of sheep; the *Blandford Farmers' Club*, which discussed, not very practically, the subject of *stable ventilation*, and also the question whether stock or cereals were most profitable; the *Derbyshire Agricultural Society*, which had before it the subject of *rotation of crops*; the *Morayshire Farmers' Club*, which had a scientific and practical discussion on the chemical means of increasing our crops

by the application of manures; the *Botley Farmers' Club*, which discoursed on the growth of root crops; and the *Winfrith*, which had before it the question of corn averages.

Overfeeding of Stock.—This was the subject of an excellent paper read before the *Banff and Turriff Agricultural Association*, by Mr Wilson, Durn. The subject, our readers will remember, was recently well handled in a paper in this 'Journal.' This gentleman made a very practical suggestion for putting an end to this pernicious system, which is destroying the breeding powers of some of the very best animals in the kingdom. The plan Mr Wilson proposed, and it seemed to meet with the approval of the members present, was, that no animals in the breeding classes, above twelve months old, which had been fed on artificial foods, should be allowed to compete at shows. "Cattle or sheep above twelve months," said Mr Wilson, "that cannot be shown in an efficient condition for breeding purposes on grass, straw, and turnip, do not deserve a prize; and I should consider it a sure evidence that they are not the sort of animals from which we ought to breed." It may be said that some animals will grow over-fat on very poor keep, and so they will; but these are the right sort to look after. In the case of younger stock, cake being very advantageous, Mr Wilson thought it should be given. If the plan proposed by Mr Wilson be carried out by our show committees—and there seems nothing to prevent it—we shall hear no more of the failures to produce live progeny which have hitherto been so common among the herds of our crack breeders, of shorthorns especially.

Continual Heavy Crops from Poor Soil.—Some curious facts as to the fertility and practical inexhaustibility of poor soil, when treated under certain conditions, come over to us from Germany. We give the paragraph as it appears in a German paper, only slightly abridged:—

Seven miles from the Prussian fortress Minden, on the left bank of the Bastan creek, lies a tract of land on which for centuries a singular method of farming has been practised with great success. The tract comprises about 3000 acres of ploughed land, and is divided into many small farms of from 15 to 70 acres each. The soil is a loamy sand, very deep, with sandy sub-soil—rather of inferior quality. Wheat, barley, beans, and peas cannot be raised on it at all; neither would beets or ruta-bagas pay for cultivation; white clover would not grow, and red clover would be a very uncertain crop; even oats do not succeed, and are sown but to a small extent. Hardly anything is raised but rye, potatoes, turnips, and a little buckwheat. Of these, rye is the main crop. The farmers there speak of hundred-year rye fields, and the oldest inhabitants assure us, that on many fields they have seen rye raised every year of their life. At the same time, their crops of rye are almost invariably good, much better than on the better soil—a rich deep loam of the neighbouring districts. In the present year (1862), for instance, the rye crop on those rich lands does not average more than 16 bushels per acre, while on the first described poorer district (which I will call Hille, after the name of the principal village), the yield has been 27 to 29 bushels. The potato crop, also, has been excellent always in Hille, even

the worst years of the disease, and large quantities have been shipped from there annually. The straw of the rye in Hille is rather shorter than that of the neighbouring districts, but it hardly ever lodges, and the grain is always heavy and of very good quality. Now, it is singular that the farmers of Hille never buy either feed or fertilisers; they have no marlbeds; their meadows are of poor quality, growing most inferior grasses, and requiring manuring themselves, and their lands are situated on high dry ground, never receiving the benefit of an inundation.

The secret lies altogether in the treatment of the manure. Every field is manured every other year. But when the manure was taken to the field directly from the stables, or when barn-yard manure was used in its natural state, which is the common practice throughout the country, very inferior crops have always been the result. By following this common practice, the farmers of Hille would soon see their fields completely exhausted; therefore they convert all their manure into compost. To obtain material for the compost-heap, they skim every sod off that can be found on roadsides, ditches, &c., and carefully collect all offals of house and field. But as there is no waste land, this source can yield but a small portion of the required material. The main part they take from the fields themselves. The fields are ploughed in lands slightly ridged. In ploughing the stubble directly after harvest, the farmer will leave a strip on each land unploughed; this strip is dug out a foot deep, and the dirt hauled to the yard. Whenever manure is thrown out of the stable, thick layers of dirt are placed between the layers of manure; the whole heap is left to ferment for months; two weeks before the time of drawing the manure to the field, the whole compost heap is forked over. This method certainly requires a great deal of labour, but it pays for all outlay. By its aid the crops are at least double of what otherwise could be grown on such soil. Nor is it difficult to find an explanation for such results of compost-making. We know that the soil contains a large store of the substances required for the growth of plants in an insoluble state. The formation of gases, and the heat created by the fermentation of the compost-heap, must be the means to transform these insoluble substances, and make them available. According to an analysis made lately by Dr Stockhardt, the soil of a certain field contained per acre, in a depth of 12 inches, 9000 lb. (German pounds, of which 100 are equal to 107 American pounds) of phosphoric acid, 75,000 of alkalies, &c. As 27 bushels of rye contain only 12½ lb. of phosphoric acid, and 8½ lb. of alkalies, the soil analysed by Stockhardt contains phosphoric acid sufficient for 706 heavy crops of rye, and alkalies enough for 8695 crops. Such a soil would therefore be capable of sustaining, for a long time, an exhausting system of cropping, if means can be found to make all its insoluble ingredients available. Dr Stockhardt has lately made some interesting experiments to ascertain the time necessary for making insoluble ingredients of the soil soluble. He took a sample of rich soil, which contained, per acre, 870 lb. of alkalies, 90 lb. of phosphoric acid, 360 lb. of silica—altogether, 2550 lb. of mineral substances in a soluble state. All these soluble substances were completely washed out by water, and the sample of soil then exposed to the alternate action of air and water. After five months, 405 lb. of alkalies, 45 lb. of phosphoric acid, 300 lb. of silica—altogether, 2640 lb. of mineral substances (per acre, and 12 inches deep) had again become soluble.

English Agricultural Implement-making.—An interesting account, though a very defective one, of English agricultural machinery is given in the introduction to the report of the jury appointed to decide on the merits of agricultural machinery in the International Exhibition last year. The great stride which has been made in this department of industry since 1851 is strikingly brought out

by the figures given. In 1852 six firms turned out 270 steam-engines for agricultural purposes ; in 1861 the same firms sent out 898—an increase of 330 per cent. In 1861 two firms, which had not directed their attention to plough-making at all in 1852, turned out no less than 9309. Of cultivators, four firms, which did not exist in 1858, or which, at all events, did not in that year make any cultivators, manufactured, in 1861, 1199 ; and of corn-drills, the manufacture of three firms have risen from 338, in 1852, to 703 in 1861. Four firms, which, as late as 1858, only made 32 reaping-machines, in 1861 manufactured 1715. These figures, however, give no adequate notion of the immense number of reapers which are now in use, as almost every implement-manufacturer of any standing whatever turns out more or less every year, and very many firms, not taken account of in the report, send out yearly upwards of a 100 each. In 1861 six firms sent out 1084 thrashing-machines ; in 1852 they only made 327. The horse-rakes of five firms have risen from 611, in 1852, to 1739 in 1861 ; and the hay-makers of two firms from 50 to 721. Chaff-cutters, made by three firms alone, have mounted up from 1004, in 1855, to 4905 in 1861 ; and five firms, which, in 1852, only made 64 corn-bruisers, in 1861 made 2680. These figures, partial and imperfect as they are, indicate how rapidly farmers are becoming alive to the necessity of obtaining all the mechanical aid they can in their work.

Steam-Ploughs.—The two principal manufacturers of these implements—the Messrs Fowler and Co., and the Messrs Howards—have been in the law-courts about an infringement of patents by the latter. It was alleged by Mr Fowler that the latter had adopted, without his sanction, the principle of the balance plough, and the courts, up to this stage, have supported the allegation. The trial, however, brought out that the real inventor of the principle of counterpoise in the plough is an obscure schoolmaster in Northumberland—a Mr Fiske—who had, for some small consideration, sold his idea to Mr Fowler, who, however, has made several important improvements in the implement since it came into his possession. This is only one of the many cases where the poor speculative student has had to stand aside, while the practical monied man rode past him to fame and fortune on his idea.

Reaping Machines are likely to be more in use this year than ever. Samuelson's excellent self-deliverer is a favourite down in the Roxburgh and Berwick districts, and it has a competitor in M'Cormick's, which, however, seems altogether a clumsier article, though the work it did last harvest, so far as it was tried, was very good. It showed, however, greater liability to breakage than its opposing machine. Along with these two, which, so far as we know, were last year the only really efficient self-deliverers in the market, there is likely to be a third this year from the workshop of Mr Jack of Maybole, well known in the West as an excellent maker of manual-

delivery reapers. This machine is of somewhat novel construction. According to an *Agricultural Journal*, the self-delivery apparatus consists of a tilting-board divided into two unequal parts, but united together by hinges, the portion nearest the cutter, or fore-end of the machine, being the narrowest. The back part of the platform has an angular-hinged division made in it to aid in throwing off the sheaves. This tilting board is actuated by many-jointed iron arms, which derive their motion from a friction-plate in connection with the driving gear, and which, at intervals, varying from nine to nineteen feet according to the nature of the crop, lift up the board and deposit the sheaf. The front part of the platform rises with double the speed with which the hind portion is depressed—an arrangement which would seem to insure that the sheaf will be well and squarely thrown off. To prevent a short straw crop falling between the platform and the knife, a bar of wood has been placed across, underneath. A reel is employed to bring the grain down to the knife. We will watch the trials of this machine during the harvest with interest, as there can be no doubt that the great desideratum in reaping machines is a self-delivery of the sheaves, the manual machines now in the market being almost all pretty perfect in their cutting gear.

Town Sewage.—This somewhat unsavoury subject has been the occasion of much angry and personal discussion in the House of Commons and elsewhere during the quarter—seemingly realising the proverb that “one cannot touch pitch without being defiled.” The result of the debates in the House of Commons was that the analysis of evidence prefixed to the Second Report of the Select Committee on Sewage, and written by the chairman, Dr Brady, an enthusiastic and somewhat credulous believer in the value of sewage for agricultural purposes, has been cancelled by the House as not being warrantable. Everybody, indeed, who read the evidence of the witnesses, was surprised at the partial character of the analysis. There can be no doubt at all that the value of town-sewage, under certain conditions, is very great, but the likeliest way to disgust people with the subject altogether is the too enthusiastic puffery of those who regard it as the panacea of British agriculture.

Farm Steam-Boiler Explosions.—In our last summary we referred to this as a most important matter for the consideration of farmers. Since that date Mr Sadler, Ferrygate, has brought it before the *Haddington Farmers' Club* in a very excellent paper, but little discussion was excited. That there is great recklessness exhibited by farm-servants, into whose charge steam-boilers are committed, is abundantly proved; and that there have as yet been comparatively few accidents on farms is due to the fact that boilers are not worked up to half the amount of pressure they are calculated to bear, and therefore not at all economically. Besides the Association in Manchester, to which we referred in a previous Number, there is

another, an Assurance Association, which extends its operations to Scotland, and whose charges for assurance appears particularly moderate.

All boilers insured by the company are inspected, not only at periodical intervals, but at any other time when necessary, 'the object of the company being to insure, as far as practicable, safety and economy in working.' All damage (save from fire) resulting from explosion or collapse of flues, whether to the boiler itself or to the surrounding property, is made good by the company, to the full amount insured. No additional charge is made for examining and inspecting the boilers insured, or for engineering advice relating thereto, the rates of premium covering all expenses. No arbitrary conditions are imposed on insurers; the boilers proposed for insurance being classified and accepted in their actual state, unless, on inspection, they are found to be absolutely unsafe. 'The inspectors will, if required, indicate the engines of the insured, and advice will be given by the chief engineer of the company in all matters relating to the economical use of steam power.' The rate for indication, including a report from the principal engineer, is 7s. 6d., if made at the ordinary visits of the inspectors, which is once in every three or four months; if at a special visit, the charge is increased to 10s.

The boilers are classified by the company according to excellence, A, B, C, the rate of premiums being according to the quality of the boilers and the amount of pressure, thus—

Class.	Above And not exceeding	lb. — 20	lb. 20 40	lb. 40 60	lb. 60 —	{ Pressure per square inch to which safety-valves are loaded.
A	Premium, . . .	0 $\frac{3}{4}$	1	1 $\frac{1}{4}$	1 $\frac{1}{2}$	{ Per cent per annum.
B	" . . .	1	1 $\frac{1}{4}$	1 $\frac{1}{2}$	1 $\frac{3}{4}$	
C	" . . .	1 $\frac{1}{4}$	1 $\frac{1}{2}$	1 $\frac{3}{4}$	2	

But besides insuring boilers, the company also undertake, at a cost of 17s. 6d. per annum per boiler, *without insurance*, to examine at their periodical visits the boilers of all who wish their services. The sense of security which such efficient inspection would give seems well worth so small a sum, even if nothing were to be saved by the advice as to economical working which skilled engineers could give.

ABERDEEN.

ARGYLL.

AYR.

BANFF.

BERWICK.

BUTE.

CAITHNESS.

CLACKMANNAN.

DUMBARTON.

DUMFRIES.

EDINBURGH.

ELGIN AND MORAY.

FIVE

FORFAR.

HADDINGTON.

INVERNESS.

G

FIARS PRICES—Continued.

KINCARDINE.

Wheat, without fodder	39/3 $\frac{1}{2}$
— with fodder	47/3 $\frac{1}{2}$
Barley, without fodder	25/5 $\frac{1}{2}$
— with fodder	30/8 $\frac{1}{2}$
Bere, without fodder	23/2
— with fodder	28/5
Oats, Potato, without fod.	22/3 $\frac{1}{2}$
— with fodder	28/11 $\frac{1}{2}$
— Common, without fod.	20/5 $\frac{1}{2}$
— with fod.	27/2 $\frac{1}{2}$
Pease, without fodder	34/8
— with fodder	42/8
Beans, without fodder	34/8
— with fodder	42/8
Rye, without fodder	25/6
— with fodder	33/6
Oatmeal, per 140 lb.	16/4 $\frac{1}{2}$

KINROSS.

Wheat	32/3 $\frac{1}{2}$
Barley, First	22/4
— Second	20/10
Bere	—
Oats, First	19/5
— Second	17/11
Pease	—
Oatmeal, per 280 lb.	34/2

KIRKCUDBRIGHT.

Wheat	44/10
Barley	29/
Oats, Potato	22/
— Common	—
Oatmeal, per 140 lb.	17/7

LANARK.

Wheat, First	40/4 $\frac{1}{2}$
— Second	34/10 $\frac{1}{2}$
— Third	28/9
Barley, First	25/9 $\frac{1}{2}$
— Second	25/5 $\frac{1}{2}$
Bere, First	24/2 $\frac{1}{2}$
— Second	—
Oats, First	21/0 $\frac{1}{2}$
— Second	19/8 $\frac{1}{2}$
— Third	17/5 $\frac{1}{2}$
Beans, First	43/
— Second	36/6
Malt, duty included	49/5 $\frac{1}{2}$
Oatmeal, per 140 lb. 1st	18/4 $\frac{1}{2}$
— 2d	16/8 $\frac{1}{2}$
— 3d	16/2 $\frac{1}{2}$

LINLITHGOW.

Wheat	36/1
Barley	27/4
Oats	21/9
Beans	37/3
Malt	49/
Oatmeal, per 112 lb.	13/9
— 140 lb.	17/2

NAIRN.

Wheat	Imp. gr. 42/11
Barley, without fodder	26/6
— with fodder	32/
Oats, without fodder	22/6
— with fodder	29/6
Oatmeal, per 112 lb.	14/8

ORKNEY.

Bere, per 350 lb.	19/4
Malt, per 140 lb. (duty)	20/2
— (exclusive of duty)	11/
Oatmeal, per 140 lb.	15/3

PEEBLES.

Wheat, First	—
— Second	—
Barley, First	29/
— Second	27/1 $\frac{1}{2}$
— Third	25/2
Oats, First	23/3 $\frac{1}{2}$
— Second	21/2
— Third	18/9
Pease and Beans, First	—
— Second	—
Oatmeal, First, per 140 lb.	17/9 $\frac{1}{2}$
— Second	17/5 $\frac{1}{2}$
— Third	16/10 $\frac{1}{2}$

PERTH.

Wheat, First	36/3
— Second	27/10
Barley, First	25/7
— Second	20/3
Oats, First	21/7
— Second	17/5
Pease and Beans	34/3 $\frac{1}{2}$
Rye	22/
Malt	—
Oatmeal, per 140 lb.	18/

RENFREW.

Wheat, First	37/3
— Second	35/4 $\frac{1}{2}$
Barley, First	28/1
— Second	25/10
Bere, First	27 4 $\frac{1}{2}$
— Second	—
Oats, First	24/1 $\frac{1}{2}$
— Second	22/5
Beans, First	38/
— Second	—
Oatmeal, First, per 140 lb.	18/7 $\frac{1}{2}$
— Second	18/5 $\frac{1}{2}$

ROSS AND CROMARTY.

Wheat, First	Imp. gr. 42/9
— Second	39/5 $\frac{1}{2}$
Barley	26/3 $\frac{1}{2}$
Bere	—
Oats, First	22/2
— Second	21/1 $\frac{1}{2}$
Pease	37/4 $\frac{1}{2}$
Beans	38/
Rye	—
Malt	—
Oatmeal, per 140 lb.	18/5 $\frac{1}{2}$

ROXBURGH.

Wheat	45/9 $\frac{1}{2}$
Barley	39/9 $\frac{1}{2}$
Oats	23/3
Rye	—
Pease	39/1 $\frac{1}{2}$
Beans	39/5 $\frac{1}{2}$
Oatmeal, per 140 lb.	17/5

SELKIRK.

Wheat	—
Barley	29/0 $\frac{1}{2}$
Oats, Potato	22/8
— Common	20/6
Pease	41/4
Oatmeal, per 140 lb.	17/4
— 280 —	34/8

STIRLING.

Wheat	37/3 $\frac{1}{2}$
Barley, Kersae	26/3 $\frac{1}{2}$
— Dryfield	27/6 $\frac{1}{2}$
Oats, Kersae	22/6
— Dryfield	22/2
— Muirland	18/
Beans	34/10 $\frac{1}{2}$
Malt, duty included	55/
Oatmeal, per 140 lb.	17/9

SUTHERLAND.

Wheat	55/
Barley	26/3
Bere	23/10
Oats	24/
Rye	—
Pease	—
Oatmeal, per 140 lb.	20/

WIGTOWN.

Wheat	39/8
Barley	28/4
Bere	25/8
Oats, Potato	21/
— Common	—
Rye	—
Pease	—
Beans	38/8
Malt	—
Oatmeal, per 280 lb.	34/11 $\frac{1}{2}$

WE may inform our English readers, that Fiars Prices are the average prices of grain, as ascertained every year, by the verdict of Juries, in every County of Scotland. The Juries are summoned in spring, and ascertain, from the evidence produced to them, the average prices of the preceding crop. By these prices, rent payable in grain, and similar contracts, are generally determined; but the main object is to convert into money the stipends (for the most part fixed at a certain quantity of grain) of the Scottish Clergy.

**AVERAGE PRICE OF THE DIFFERENT KINDS OF GRAIN,
PER IMPERIAL QUARTER, SOLD AT THE FOLLOWING PLACES.**

LONDON.

Date.	Wheat.	Barley.	Oats.	Rye.	Pease.	Beans.
1863.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
Feb. 7.	40	6 39	8 17	8 35	2 43	8 35 3
14.	50	4 40	9 21	8 35	6 44	8 34 9
21.	48	11 37	3 24	4 35	0 45	9 35 7
28.	48	8 40	10 22	3 35	10 48	8 35 6
Mar. 7.	48	0 41	1 20	8 32	3 50	8 33 4
14.	48	2 42	8 22	4 34	0 39	6 36 9
21.	46	11 39	5 22	0 33	1 32	7 34 11
28.	46	6 37	11 17	0 31	6 39	9 35 6
April 4.	46	11 41	7 18	0 29	0 32	7 35 1
11.	46	6 36	6 22	0 30	3 41	11 33 6
18.	46	1 36	4 21	10 29	8 37	4 40 0
25.	46	1 40	4 22	4 28	0 38	6 34 4
May 2.	47	1 34	6 21	2 29	8 37	7 32 8
9.	47	5 34	6 19	0 30	10 37	0 34 5
16.	47	8 39	6 27	1 31	8 36	7 33 11
23.	47	5 36	6 25	0 32	4 36	0 35 9
30.	46	9 34	8 22	0 33	6 37	0 38 6

LIVERPOOL.

Date.	Wheat.	Barley.	Oats.	Rye.	Pease.	Beans.
1863.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
Feb. 7.	45	0 32	0 23	5 32	8 35	7 38 1
14.	44	5 33	8 23	3 33	0 36	2 38 8
21.	43	2 34	6 26	8 32	6 37	2 40 0
28.	44	1 35	11 24	7 31	10 37	6 41 8
Mar. 7.	43	2 36	2 25	7 31	7 38	2 39 8
14.	43	10 35	6 23	8 31	8 41	0 38 6
21.	44	3 34	6 25	6 31	6 45	0 37 0
28.	41	6 33	6 25	1 32	4 35	8 36 0
April 4.	55	0 40	0 25	9 31	9 33	6 34 7
11.	47	2 38	6 22	2 31	4 31	7 37 4
18.	52	0 37	4 26	9 31	6 32	4 37 9
25.	46	0 36	6 26	8 30	11 33	6 37 6
May 2.	44	9 35	8 24	5 32	2 33	1 38 8
9.	45	10 34	2 25	4 31	10 34	2 38 10
16.	45	8 35	6 26	6 31	6 35	2 37 8
23.	46	6 34	4 22	11 32	0 36	4 38 2
30.	46	0 34	6 29	11 34	6 35	6 37 6

EDINBURGH.

Date.	Wheat.	Barley.	Oats.	Pease.	Beans.
1863.	s. d.	s. d.	s. d.	s. d.	s. d.
Feb. 4.	42	7 29	4 25	10 39	4 38 6
11.	41	2 28	8 25	10 39	2 38 8
18.	44	10 29	10 26	2 40	2 39 6
25.	42	5 29	4 26	8 40	7 39 7
Mar. 4.	41	8 30	3 26	6 40	9 39 6
11.	44	4 30	2 27	10 38	6 38 0
18.	44	0 29	5 28	0 39	9 38 2
25.	42	1 29	11 27	10 39	0 38 6
April 1.	43	7 30	0 27	11 38	5 38 0
8.	44	2 38	11 27	4 39	8 38 6
15.	44	5 30	1 26	10 39	10 39 2
22.	45	0 28	9 26	6 39	5 39 0
29.	45	3 29	2 27	0 39	9 39 3
May 6.	45	7 30	3 27	4 41	3 40 6
13.	44	5 30	9 28	5 39	1 38 6
20.	43	9 29	0 28	0 40	2 39 6
27.	44	5 29	10 28	2 40	1 39 6

DUBLIN.

Date.	Wheat. p. barl. 30 st.	Barley. p. barl. 16 st.	Oats. p. barl. 17 st.	Flour. p. barl. 14 st.	9 st.
1863.	s. d.	s. d.	s. d.	s. d.	s. d.
Feb. 6.	26	10 15	0 13	2 12	2 20 6
13.	26	11 15	2 13	6 12	6 20 7
20.	26	8 15	4 13	6 12	4 20 7
27.	26	10 15	6 14	0 12	5 20 7
Mar. 6.	27	6 16	0 14	4 12	2 20 8
13.	26	10 15	0 13	9 12	0 20 7
20.	26	6 15	4 14	0 12	2 20 8
27.	26	9 15	6 14	4 12	4 20 9
April 3.	26	3 16	0 14	6 12	2 20 9
10.	26	6 15	6 14	2 12	8 20 9
17.	27	6 16	0 14	6 13	7 20 7
24.	26	3 16	2 14	4 12	4 20 4
May 1.	26	4 16	0 15	1 14	0 20 4
8.	27	6 16	6 15	4 14	8 20 6
15.	27	2 16	4 15	6 15	0 20 8
22.	27	6 16	2 15	4 15	0 20 9
29.	27	8 16	6 14	6 15	0 20 9

**TABLE SHOWING THE WEEKLY AVERAGE PRICE OF GRAIN,
Made up in terms of 7th and 8th Geo. IV., c. 58, and 9th and 10th Vict., c. 22. On and after 1st
February 1849, the Duty payable on FOREIGN CORN imported is 1s. per quarter, and on Flour
or Meal 4½d. for every cwt.**

Date.	Wheat.		Barley.		Oats.		Rye.		Pease.		Beans.	
	Weekly Average.	Aggregate Average.	Weekly Average.	Aggregate Average.	Weekly Average.	Aggregate Average.	Weekly Average.	Aggregate Average.	Weekly Average.	Aggregate Average.	Weekly Average.	Aggregate Average.
1863.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
Feb. 7.	47	7 47	5 35	11 35	2 20	4 20	6 35	2 34	5 36	10 37	2 36	3 36 5
14.	47	4 47	7 36	3 35	6 21	8 20	9 33	0 94	7 37	10 37	4 36	7 36 5
21.	46	2 47	8 36	5 35	10 21	8 20	11 31	6 32	11 37	2 37	4 36	3 36 4
28.	46	7 47	4 36	6 36	1 21	9 21	2 33	4 32	8 37	8 37	4 36	4 36 5
March 7.	46	2 47	0 36	10 36	9 21	11 21	4 33	1 33	1 37	3 37	3 36	2 36 4
14.	45	3 46	6 36	7 36	5 21	4 21	5 34	5 33	5 35	11 37	1 35	10 36 3
21.	45	0 46	1 36	9 36	6 21	6 21	8 35	11 33	6 34	6 36	9 35	7 36 2
28.	45	4 45	9 36	5 36	7 21	2 21	7 32	4 33	5 36	5 36	6 35	5 35 11
April 4.	45	9 45	8 36	6 36	7 21	5 21	0 30	4 33	3 35	11 36	3 36	1 35 11
11.	45	6 45	6 36	8 36	5 21	5 21	5 31	9 33	0 35	2 35	10 35	11 35 10
18.	45	6 45	5 35	4 36	2 21	6 21	5 30	5 32	6 36	2 35	8 36	6 35 11
25.	45	8 45	6 36	3 36	0 21	11 21	6 30	6 31	10 35	3 35	7 36	11 36 1
May 2.	45	9 45	7 34	6 35	7 21	2 21	5 29	8 30	10 35	6 35	9 37	3 36 4
9.	46	2 45	9 34	4 35	8 22	1 21	7 30	11 30	7 34	6 35	4 37	6 36 8
16.	46	9 45	11 34	5 35	11 21	11 21	8 33	7 31	2 35	8 35	3 38	3 37 1
23.	46	8 46	1 33	9 34	7 22	7 22	10 34	6 31	7 36	5 35	6 38	6 37 6
30.	46	5 46	3 33	8 34	4 22	8 22	1 40	2 33	3 35	9 35	5 38	11 37 11

FOREIGN MARKETS.—PER IMPERIAL QUARTER, FREE ON BOARD.

Date.	Markets.	Wheat.				Barley.				Oats.				Rye.				Pease.				Beans.			
		s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.
1863.																									
Feb.	Danzig	26	6	32	6	16	6	22	6	13	6	16	6	20	0	24	6	25	0	32	0	28	0	33	0
March		24	6	31	0	16	0	21	6	14	0	17	0	19	6	24	0	26	0	32	6	27	6	32	0
April		25	6	32	0	15	6	21	0	14	6	18	0	18	6	23	6	25	0	31	6	26	6	31	6
May		26	0	33	0	16	6	23	0	15	0	18	6	19	6	24	0	24	0	30	0	28	0	33	6
Feb.	Hamburg	28	6	34	6	16	6	23	6	14	6	17	6	20	0	25	0	26	0	33	0	28	6	34	0
March		26	6	32	0	15	6	22	6	15	0	18	0	19	0	24	6	25	6	32	6	27	6	33	0
April		25	6	31	6	16	0	23	0	15	6	18	6	18	6	23	6	25	0	31	6	28	0	33	6
May		27	6	33	6	16	6	23	6	15	6	18	0	19	6	24	0	26	0	32	6	28	6	34	6
Feb.	Bremen	28	6	34	0	16	0	22	0	13	6	16	6	20	0	25	6	25	6	30	0	27	6	33	0
March		27	6	32	6	15	6	20	6	14	0	17	6	19	6	24	0	24	6	31	0	27	0	32	6
April		26	6	32	0	16	0	21	6	14	6	17	6	19	0	23	6	26	0	33	0	27	6	33	0
May		28	0	33	6	16	6	22	0	15	0	18	0	20	0	24	6	26	6	34	0	28	0	34	0
Feb.	Königsberg	28	6	33	6	15	6	20	6	13	6	16	6	20	6	25	6	26	0	31	6	27	6	33	0
March		27	6	32	0	16	0	21	6	14	0	17	6	19	6	24	0	25	6	31	0	26	6	32	0
April		27	0	31	6	16	6	22	0	14	6	17	6	19	6	24	6	26	6	33	0	27	6	33	6
May		28	0	34	0	16	0	21	6	15	0	18	6	20	0	25	6	27	0	33	6	28	0	34	0

Freights from the Baltic, from 3s. 9d. to 5s.; from the Mediterranean, from 9s. to 12s.; and by steamer from Hamburg, from 4s. to 6s. per imperial qr.

THE REVENUE.—FROM 31ST MARCH 1862 TO 31ST MARCH 1863.

	Quarters ending March 31.		Increase.	Decrease.	Years ending March 31.		Increase.	Decrease.
	1862.	1863.			1862.	1863.		
	£	£	£	£	£	£	£	£
Customs	5,724,000	5,721,000	..	3,000	23,674,000	24,034,000	360,000	..
Excise	5,044,000	4,665,000	..	379,000	18,332,000	17,155,000	..	1,177,000
Stamps	2,293,945	2,374,000	80,055	..	8,590,954	8,994,000	403,055	..
Taxes	355,000	357,000	2,000	..	3,160,000	3,150,000	..	10,000
Post-Office ..	905,000	955,000	50,000	..	3,510,000	3,650,000	140,000	..
Miscellaneous	857,669	1,250,746	393,077	..	2,042,534	3,553,561	1,006,027	..
Property-Tax	4,427,000	3,890,000	..	537,000	10,365,000	10,567,000	202,000	..
Total Income	19,606,614	19,212,746	525,132	919,000	69,674,488	71,103,561	2,111,082	1,187,000
Deduct increase .....	..	..	..	525,132	Deduct decrease .....	..	1,187,000	..
Increase on the qr. ....	..	..	..	393,868	Increase on the year .....	..	924,082	..

PRICES OF BUTCHER-MEAT.—PER STONE OF 14 POUNDS.

Date.	LONDON.				LIVERPOOL.				NEWCASTLE.				EDINBURGH.				GLASGOW.			
	Beef.	Mutton.	Beef.	Mutton.	Beef.	Mutton.	Beef.	Mutton.	Beef.	Mutton.	Beef.	Mutton.	Beef.	Mutton.	Beef.	Mutton.	Beef.	Mutton.	Beef.	Mutton.
1863.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
Feb.	7 3	8 3	8 3	9 0	7 6	8 6	7 6	8 6	7 0	8 0	7 6	8 6	7 9	8 9	7 9	8 9	8 0	9 0	8 0	9 0
March ..	7 6	8 6	8 6	9 3	7 3	8 3	7 9	9 0	7 3	8 3	7 9	8 9	7 9	8 9	7 9	8 9	7 9	8 9	8 0	9 0
April ...	7 6	8 6	8 6	9 3	7 3	8 6	7 9	9 0	7 3	8 6	7 9	8 9	7 9	8 9	7 9	8 9	7 9	8 9	8 0	9 0
May	7 9	8 9	8 6	9 6	7 6	8 9	8 0	9 3	7 6	8 9	8 0	9 0	8 0	9 0	8 0	9 0	8 0	9 0	8 0	9 3

PRICES OF ENGLISH AND SCOTCH WOOLS.—PER STONE OF 14 POUNDS.

ENGLISH.		s. d.	s. d.	SCOTCH.		s. d.	s. d.
Merino, .....	..	22 0	to 27 6	Leicester Hogg, .....	..	24 0	to 28 0
.. in grease, .....	..	17 6	.. 22 6	.. Ewe and Hogg, .....	..	20 0	.. 24 0
South-Down, .....	..	22 0	.. 28 0	Cheviot, white, .....	..	18 0	.. 23 0
Half-Bred, .....	..	17 0	.. 21 6	.. laid, washed, .....	..	15 0	.. 19 0
Leicester Hogg, .....	..	24 0	.. 28 0	.. unwashed, .....	..	12 0	.. 14 6
.. Ewe and Hogg, .....	..	21 0	.. 25 0	Moor, white, .....	..	11 0	.. 14 0
Locks, .....	..	11 6	.. 13 6	.. laid, washed, .....	..	10 0	.. 13 0
Moor, .....	..	9 0	.. 11 6	.. unwashed, .....	..	8 0	.. 9 0

THE IMPROVEMENT OF PASTURES, BOTH PERMANENT AND
ON LAND UNDER CULTIVATION.

"WE have pastures for summer feed, we have capabilities for rearing root crops to make up the supply when the summer food fails, and we have the opportunity, if we have the judgment, the skill, and the liberality to do it, to raise beef and mutton beyond any other country on the face of the globe."

Such were the terms in which that well-known veteran agriculturist, Mr John Grey, late of Dilston, addressed a meeting of Northumberland farmers, when discoursing to them, at Hexham in 1859, on the 'Future Prospects of Agriculture.' Pasture and roots,—in other words, convertible husbandry, mixed farming, the sheet-anchor of British agriculture, the primary cause of its past progress, and the surest foundation on which to build our expectations of its future success.

It is our intention, in the following remarks, to confine ourselves to one branch of the subject—our pastures, and the best modes of improving them, when circumstances render improvement necessary. This is, we consider, a subject of much importance, because it is but too evident that the state of our pastures in many cases is by no means what it ought to be, either as regards the interests of the proprietor or the farmer, or the requirements of the community. And we must observe that, in this, as in all matters connected with agriculture, it is not private interests alone we have to consider; for those who follow it as a pursuit are food-producers for the nation, and the nation's comfort is materially affected by everything which tends, on the one hand, to restrict the produce of the soil, whatever shape it may assume; or, on the other, to increase that production. Beef and mutton, and the products of the dairy, are essentially necessities of life, and thus the green pastures of our country are not less valuable in their own place to the community than the golden-hued corn-fields. It is true that this view of the case is perhaps of too abstract a nature, at least for those who are more immediately concerned in the matter—those who own the land, and those who occupy it as farmers; and as it is with those parties we have chiefly to do at present, we shall keep in view the question of the immediate advantages or disadvantages which result from the state of their pastures, according as these are improved to the highest point of which they are capable, or the reverse.

Pastures are divisible into two classes—(1) those which are of a permanent nature; and (2) pastures which form part of a regular rotation.

The permanent pastures are also of two kinds—(1) those formed by the spontaneous growth of the grasses; and (2) those which

have been artificially laid down with the intention of the same remaining as pasture-fields for a series of years—a longer term, in fact, than is attainable where a regular succession of crops is carried out. This latter division often passes into the first, in consequence of many of the grasses which were originally sown having died out, and being gradually replaced by others indigenous to the soil. Of this we meet with numerous illustrations in England and in Ireland, and occasionally in Scotland, where we sometimes see the mark of furrows on hill-sides, denoting that cultivation has been carried on in such localities at a remote period—beyond the recollection, perhaps, of even “the oldest inhabitant”—but showing to this day a brighter, closer, and altogether a different sward from that which exists on the land adjoining, which evidently remains as it was at that uncertain period when Britain “arose from out the azure main.” It is quite possible that the grasses growing on such places are altogether of spontaneous growth; and we need not feel surprised that such is the case, for the soil is full of the seeds of plants lying dormant until some agency favourable to their vegetation calls them into life. Cultivation effects this in the case of numerous plants, and it is also brought about by the application of certain substances. For example, if we top-dress a piece of ground which is covered, while in its natural state, with a dense growth of heather, with lime, shell-sand, or rich marl, the result will be that the heather will gradually disappear, and the surface will become covered with a close growth of grasses of a finer character, among which white clover will be most conspicuous.

The rich natural pasture-fields met with in some parts of England and the sister country have been formed by the growth of grasses indigenous to the soil; and the quality of the soil being at the same time favourable to the growth of such grasses as possess the largest amount of nutritious properties, the pastures formed by the accumulation of plants of this kind are of the most valuable description, and capable of yielding the greatest amount of produce, in the shape of beef and mutton, which any pastures can produce. In other cases, where the soil is of an inferior nature, the grasses spontaneously grown upon them are, in like manner, inferior to those grown on a deeper and richer class of soils; and hence the difference in the feeding qualities of natural pastures, even when there are no other agencies at work to cause inferiority than merely the difference in the natural constitution of the different soils. Still, although the richest soils produce the best and most nutritious grasses, many plants will also be found growing upon them which are of very little value, and the number of these is increased when the land suffers from certain causes which tend to counteract and lessen its natural fertility.

Of these, the most prominent is a superabundance of moisture stagnating in the soil. The evidence of this is found in the rushes,

and other coarse grasses which can only thrive where the land is surcharged with water ; and notwithstanding all that has been said and written regarding the profitableness of efficient drainage, and the universal assent which is given whenever the advantages of this step are pointed out, yet we cannot fail to see on every hand vast tracts in evident need of it, covered with vegetation of a very inferior order, and engendering disease among the animals which are kept upon such pastures.

There has been rather a difference of opinion as to the manner in which the draining of permanent pastures should be done. Some do not consider that pasture should be drained in so thorough a manner—that is, with regard to the depth of the drains, and the width between them—as they would prefer when it was intended that the land should be occasionally tilled. They argue that herbage requires a different condition of soil and climate through a great part of the year than that which is necessary for the growth and maturing of corn ; that the richest pastures are found in moist situations, where the surface is not more than 2 or 3 feet above the water-bed ; that the humidity derived from this proximity to moisture promotes a continuance of herbage-growth during the droughts of summer ; and, therefore, that any system of drainage which would lower the water-bed below 3 feet is to be avoided. There is no doubt a good deal in this reasoning, but, in our opinion, the drainage of pasture, like every other description of land, must be regulated very much by circumstances. Some soils are more retentive of moisture than others, and in some parts of the kingdom there is a double amount of rainfall as compared with other places. Where we have an excessive rainfall and a retentive soil combined, we must drain more closely than we would require to do, even on the same description of soil, where the rainfall was perhaps 100 per cent less on the average. We are not at present arguing the question of deep, or what is called shallow drainage, but we may take occasion to say, from our own personal experience, as well as the results of observation in many parts of the kingdom, that the most effective drainage is that which we find in drains cut 3 feet deep, and 18 to 21 feet apart. So far as pastures are concerned, we must alter the state of the soil, so that it will no longer remain favourable to the growth of water-plants. It does not matter whether the drains are 18 feet or 30 feet apart, and 3 feet or 5 feet deep, so long as there are rushes, or other indications of stagnant under-water injuring the surface vegetation. We must get rid of that water, otherwise the drainage of the land is imperfect. There are some pastures also which appear dry enough, perhaps, in summer, but during winter, or long-continued wet weather, they get spongy, and the stock never have a dry bed ; there are few rushes, however, and at certain periods one would almost be inclined to say that drains were not required. The grasses, however, are poor, and a short

practical experience of such lands will soon show that drains are necessary.

When wet land has been drained, the result will be, that the coarse grasses which could only thrive while a superabundance of moisture existed in the soil, will die out ; but in such cases it frequently happens that many years elapse before other and better grasses fill up their place. This has led some people to say that draining injures pastures, and that it produces an effect on the soil which is best described by the term we have heard applied to it under such circumstances,—that is, it becomes “hidebound.” It assumes a hard, dry, semi-sterile appearance, which makes people almost, and, we believe, actually regret the want of the coarse grasses which formerly abounded on the same land, and which, if of little real actual value, imparted, at least, a fertile look to the surface. How is this to be remedied ? There is, in our opinion, only one efficient course to be taken ; the land must be broken up and subjected to a course of thorough tillage ; not mere surface work, to get “a skin” on it, as we have sometimes seen done in such cases, but a thorough, perfect system of tillage in every respect. The Tweeddale plough, and its indispensable and invaluable adjunct the Tweeddale subsoil-trench-plough—steam-drawn if you will—must be called in to create, as it were, a body of thoroughly comminuted soil such as will allow the roots of plants to ramify in all directions, and draw in that nourishment from a suitably prepared soil which is requisite to secure a strong growth of rich herbage. With deep and efficient cultivation there must be liberal manuring ; but so great are the benefits derivable even from deep tillage alone, as effected by the Tweeddale implements following thorough-draining, that we have seen really excellent pasture on land which had been simply subjected to the operation of those implements, and then laid down actually without manure. Nor was there any extraordinary natural fertility in the soil to bring about that result. On the contrary, it was of a very inferior description in its natural state—a cold, stiff clay soil, of a dirty white colour. In this case it was clearly evident that the increased fertility, both in point of corn-growing and grass produce, arose, as Mr Stephens has remarked with reference to the Yester farms, more “from the changes effected in the state of the surface-soil, resting upon a deeply pulverised subsoil, than from that derived from the use of extraneous manures.”

But, while desirous of insisting in the strongest possible terms on the absolute necessity which exists for deep and perfect tillage as an essential preparatory step where superior permanent pasture is desired, we would not recommend a universal reliance on it alone, and believe that in this, as in all cases of farm management, “muck is the master.” A root crop will of course precede the grasses, and that root crop should be not only well manured, but, on its removal, at least ten or twelve tons of farmyard dung per acre ought to be spread over the surface and ploughed down, so that it may be well

incorporated with the soil before the seeds are sown. Where the turnip crop is consumed by sheep folded upon it, this manuring will not be required; but there are many places where the land does not suit folding, and as the turnip crop in such cases must be consumed elsewhere, the final manuring we have mentioned should not be omitted. And there is another point we must mention in connection with manuring preparatory to permanent pasture. The use of bone superphosphate and other phosphatic manures has greatly restricted the use of bones in their natural state, but when we are manuring for a turnip crop preparatory to permanent pasture, bone-dust should be used in preference to the other forms of phosphatic manures, because the fertilising effects of the bone-dust are more lasting. We have seen the effect of bones distinctly visible many years after application, the contrast between that part of the pasture which had been laid down after bones, and that which had been sown after farmyard dung, being all the greater from the fact that the boned portion was in the centre of the field. Fifteen years ago we laid a large field down to permanent grass, after a full dressing of farmyard manure, and in the following year another close beside it with half dung and eight bushels of bones to the imperial acre for the turnip crop; the roots being in both cases removed and consumed by house and yard-fed cattle. The soil in both cases was the same, a medium clay loam, but the pasture on the boned field was always much superior to the other; and while it still remains in grass, the field which was laid down after dung required to be broken up two years ago, owing to the inferior state of the pasture. Lime is also, in the generality of cases, essential to the permanency of pasture. We have frequently tested this point, and feel perfectly satisfied with regard to it. We have, however, seen a great deal of land laid down to permanent grass without being limed, and we would, therefore, from the results of our own experience, desire to press this point in the preparatory management of the land upon the attention of those who intend sowing it down to grass for a succession of years. Our practice has been to put on the lime when working the land before sowing the turnip crop, as it has a tendency to sink rapidly in the soil. Rich clean land is absolutely necessary for success in this case, and we believe, indeed, that grasses for permanent pasture should rarely be sown unless after two root crops following each other. This system of successive root crops has, indeed, much to recommend it under almost any circumstances, and we feel convinced that it will yet become quite as common as a succession of two grain crops was at one time, and in fact still is in many parts of the kingdom. The crops are varied in each year, where the system of two successive root crops is properly followed. Thus, in those parts of the kingdom where the climate is suitable for the cultivation of mangolds, a crop of that description of roots, manured with farmyard dung and salt, is first grown, followed by a crop of swedes and other turnips manured with bones

and other artificial manures. The last-named crop is sometimes partly consumed on the ground by sheep, but when this is not done, the dressing of farmyard dung, already mentioned, should not be neglected. In carrying out this system, a crop of potatoes can be followed by another of swedes, &c., and *vice versa*, or a crop of swedes may succeed one of yellow Aberdeens. The requirements of our meat markets have become even more pressing and important than those of our corn markets, and an arrangement of our cultivated crops which allows such an extensive command of food for stock as that which we obtain by the root crops following each other in the course of a rotation, is a matter worthy of the greatest consideration. As a suitable preparation for permanent grass, there can be little doubt as to the advisableness of the system; taking it for granted, of course, that all the details are attended to in a proper manner.

From the practice of sowing grass seeds along with a corn crop being so general, it is evident that any system which would set that corn crop aside would likely be regarded by many as expensive and unprofitable. But although there is, of course, great inducement to sow the grass seeds along with a corn crop in the course of a rotation when the pasture is limited to one or two years, it is decidedly more advisable to sow the seeds without a corn crop when permanent pasture is the main object. A small quantity of grain, say a bushel an acre, may indeed be sown at the same time, in order to afford some degree of shelter to the young grasses, but this cannot be looked upon as a regular corn crop, grown for the sake of the produce. In fact, we prefer sowing rape, say from 2 to 3 lb. an acre, along with the grass seeds, instead of any of the cereals, as shade is sufficiently afforded by such a mixture, while the rape yields, at the same time, a considerable amount of good keep for stock.

The next point to be considered is the kinds and quantities of grass seeds which should be sown in order to produce good pasture. Most seedsmen have favourite mixtures of their own, and the following is the formula given by Mr Sutton, Reading, in the 22d volume of the 'Journal of the Royal Agricultural Society of England,' as suitable for medium soils:—

<i>Alopecurus pratensis</i> (meadow foxtail)	1 lb.
<i>Anthoxanthum odoratum</i> (sweet-scented vernal grass)	1
<i>Cynosurus cristatus</i> (crested dogstail grass)	0½
<i>Dactylis glomerata</i> (cocksfoot)	1
<i>Festuca duriuscula</i> (hard fescue)	2
<i>pratensis</i> (meadow fescue)	4
<i>ovina</i> (sheep's fescue)	4
<i>rubra</i> (creeping or red fescue)	2
<i>tenuifolia</i> (fine-leaved fescue)	2
<i>loliacea</i> (spiked fescue)	2
<i>Lolium perenne sempervirens</i> (evergreen perennial ryegrass)	6
<i>Lolium perenne tenue</i> (fine-leaved ryegrass)	4
<i>Phleum pratense</i> (timothy)	1

Poa pratense (smooth-stalked meadow grass)	lb.
„ trivialis (rough-stalked meadow grass)	1
„ nemoralis (wood meadow grass)	1
Medicago lupulina (yellow clover)	1
Trifolium repens (white clover)	4
„ „ perenne	4 (?)
„ pratense perenne (perennial red clover)	1
„ hybridum (alsike)	2
	<hr/>
	46½

Some of the grasses in the foregoing mixture are of very doubtful value—the dogstail grass, for instance, the early withered stalks of which are known in Scotland as “windle-straws.” The proportions of the best grasses also do not appear to be judiciously considered; and, altogether, we certainly do not look upon it as a desirable or a profitable mixture.

The Messrs Lawson, of Edinburgh, to whom the agricultural world is so indebted for much valuable information relative to grasses, published lists of the different kinds which should be used under different circumstances, in their ‘Agriculturist’s Manual,’ which was issued in 1836. The following are two of the mixtures which that eminent firm then recommended for medium soils, sown without a crop:—

Meadow foxtail,	lb.
Cocksfoot,	2
Hard fescue,	5
Various-leaved fescue,	2
Meadow fescue,	1
Perennial ryegrass,	3
(or perennial ryegrass 7 lb., and Italian 4 lb.)	12
Timothy,	1½
Rough-stalked meadow grass,	2
Yellow clover,	1
Perennial red clover (cowgrass),	4
White clover,	5
	<hr/>
Total, per imperial acre,	38½

The second formula for permanent pasture was as follows:—

Meadow foxtail,	lb.
Sweet-scented vernal grass,	2
Cocksfoot,	0½
Hard fescue,	2
Meadow fescue,	3
Creeping fescue,	3
Perennial ryegrass,	2
Timothy,	10
Wood meadow grass,	1½
Rough-stalked meadow grass,	3
Cowgrass,	3
White clover,	5
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Total, per imperial acre,	38

We used Lawson's mixtures for several years, as given above, particularly according to the second formula, but we improved upon it, at least in our own opinion, by substituting 2 lb. per acre of sheep's fescue for the creeping or red fescue. We added 2 or 3 lb. of Italian ryegrass, deducting a suitable proportion of perennial; and latterly, we also added 2 lb. of alsike clover, a most valuable variety either for hay or pasture, and particularly so where there is any danger of failure in the case of the ordinary red clover. The Italian ryegrass dies out after two years, but it gives an abundance of early feed while it lasts, and if a crop of hay is taken, the bulk is considerably increased by this variety of ryegrass.

Further experience has enabled the Messrs Lawson to improve their mixtures of grass seeds, and we take the following from their work on the 'Cultivated Grasses,' published in 1856.

	lb.
Meadow foxtail,	2
Vernal grass,	0½
Yellowish oat grass,	1
Cocksfoot,	5
Hard fescue,	2½
Tall meadow fescue,	2
Various-leaved fescue,	2
Meadow fescue,	3½
Italian ryegrass,	8
Perennial ryegrass,	10
Timothy,	2½
Wood meadow grass,	1½
" " " evergreen,	1½
Rough-stalked meadow grass,	2½
Birdsfoot trefoil,	0½
Greater trefoil,	0½
Yellow clover,	1
Alsike "	2
Red "	1½
" " perennial,	3½
White "	5
Total, per acre,	57½

The above is intended for medium soils, and sown without a crop; when sown with a crop, there is a slight decrease in some of the seeds. In some very successful mixtures we have seen used, there is a larger proportion of the fescues than in Lawson's mixtures, also more alsike clover, and not so much Italian ryegrass. There are some, we dare say, who imagine that it is a useless expense sowing such a number of different grasses, but this is a mistake. The object is to obtain a sward which shall consist, as nearly as possible, of the best and most nutritious grasses; and it must be remembered that such a variety as that which is contained in the foregoing mixtures gives a succession of grasses, some of the kinds being more forward than others, so that when one or two kinds have passed their best stage, others are coming on to supply their place, and thus the feeding properties

of the pasture are maintained throughout the season. The little extra expense incurred by a varied and proper mixture is thus very soon repaid.

Grass-seeds should not be deeply covered ; and many failures can be easily traced to an error in this particular point of the management. We have preferred the bush-harrow, followed by rolling ; and a good deal of the success of the pasture depends on the frequent use of the roller. When the seeds have been sown with a crop, there will probably be blanks in some parts of the field. Some seed must be sown on the removal of the crop wherever the grass plants are thin, and the roller used at that time, followed by a second and even a third application of that implement before winter. This will strengthen the plants, and enable them to stand the winter better. We do not like mowing grass which has been laid down for permanent pasture, although recommended on high authority—believing that it is unnecessarily trying on the land, and to some extent injurious to the grasses. Pasturing at first with young cattle, and then with sheep, is decidedly to be preferred, but the grass must not be “eat to the bone,” as it is termed, and any rough “teathy” spots which may occur should be cut over with the scythe. If the land has been well cleaned beforehand, weeds will not likely be troublesome ; but the most unremitting care must be given to these intruders, and all taken out whenever they make their appearance. Thistles, rag-worts, docks, &c., are quite inadmissible in pastures, and their presence at once betokens either great ignorance or great laziness.

When the grass-seeds are sown with a corn crop, it must, of course, be done during the spring months—say from the middle of March until the end of April, according to situation and other circumstances. In an early climate, and in the case of warm soils, such as we meet with in some parts of England and Ireland, the grass-seeds may be sown in autumn, during the months of August and September ; but even in such cases the sowing should be made as early as possible during these months, from the risk there is of losing a considerable proportion of the clover-plants and the finer grasses, should the winter prove severe. When autumn-sowing is practised, it is usually on land which has been either partially fallowed, or on land which has produced a crop of early potatoes. Where the soil and climate are alike favourable, it is by no means uncommon to find the young grasses and rape—for a few pounds per acre of rape are sown, in such cases, along with the seeds—so far advanced as to require being run over with the scythe in October, in order to prevent the finer grasses from being smothered ; while in other instances the grasses are left untouched until January and February, at which time yearning ewes are put on, the abundance of succulent food yielded by the pasture producing a large flow of milk for the early-dropped lambs. When the grasses

have been tolerably eaten down, the sheep are removed, and the pasture allowed to recover in order to be again stocked in a few weeks after, the growth being rapid, or else preserved for a hay crop. It is, however, only in what may be considered exceptional cases that autumn-sowing can be relied on when permanent pasture is the object; and, in general, we must consider the spring months as the best suited for this purpose, whether the grass-seeds are sown with or without a cereal crop.

But while we believe that worn-out pastures will be more improved by following the course we have sketched than by any other system, it may happen that it would be inconvenient to break up the land, while the improvement of the pasture is at the same time a matter of absolute necessity. To this point, therefore, we shall now direct our attention.

Old pastures are often subject to become overrun with moss or fog, which choke the grasses. Drainage will of course, in such cases, be probably required, although we have sometimes met with cases where fog was abundant, but where it was quite evident that the land did not stand in need of draining. In such instances we have no doubt the existence of the fog was attributable partly to a humid climate. This fog must be got rid of, and usually sharp-toothed harrows are employed for the purpose. We have also seen an implement which we believe did the work well: it was constructed precisely on the same principle as "Tennant's Grubber;" but the tines were short—that is, in point of perpendicular elevation from the level of the ground—as they did not exceed 9 inches in perpendicular height. The tines were curved or swan-necked, and when at work they did not penetrate over an inch or an inch and a half; but they could be set to work at different depths according to pleasure. The ground, after being scarified in one direction, was then crossed with the implement, the result being the complete loosening of the fog, which was then gathered, and grass-seeds sown on the raw surface. The grass-seeds, where this is done, will be just such a mixture as those of which we have given formulas, and the land should afterwards be frequently rolled. A damp morning should be selected for sowing the seeds.

But although this will effect a considerable improvement in the nature of the pasture, the benefit of scarifying the surface and removing the fog will be greatly increased if a top-dressing is applied before or after the grass-seeds have been sown. Top-dressings may consist either of pure farmyard dung, or of the same in a compost with earth; and there are also other materials which may be used for the same purpose. When farm dung is employed, it ought to be tolerably well rotted, and after it is spread over the surface, its perfect distribution should be still further secured by crossing and recrossing the field with a bush-harrow. This operation is also necessary when compost is used, as it not only distributes the manure

more equally, but brushes it well in about the plants. The quantity of farmyard dung applied should not certainly be less than 10 or 12 tons an acre, nor would we reckon on a less quantity even when the bulk was increased by other material, as in the case of a compost of dung and earth. When a compost of this kind is made up for the purpose of top-dressing pasture, it should be kept in view to procure earth for the compost of a different texture, if possible, from that of the field to which it is intended to apply it. We are aware this is not always practicable, still, wherever it can be done, it should be attended to. Thus a field of pasture growing on a clay soil should be top-dressed with dung mixed with sandy loam or with peat-earth; and the pasture on a light soil with something of a heavier nature. Peat-earth makes a good mixture for composts to be applied to any soil except one of its own nature, nor is it to be cast aside as worthless even in the case of a peaty soil, provided the "bog mould," as it is called in Ireland, is thoroughly saturated with liquid manure, and properly mixed with dung. When abundant, it makes excellent material to put beneath cattle which are fed in houses; and when this is done, it absorbs the material (cattle urine), which will render it most useful as a top-dressing.

Composts for top-dressing may be also formed of broken bones and earth; and if the heap is thoroughly wetted with liquid from the tank, or, failing that, even common water, a mass of most valuable manure will be obtained in a very short time, for the bones are easily heated. It is well known that bones applied as a top-dressing have a wonderful effect in renovating worn-out pastures, especially those upon which dairy-cows and young cattle have been kept for a series of years; but we prefer the compost form of application to that of applying bones in the simple form of bone-dust. Taking all things into consideration, we think that bones which have been prepared in a compost act more speedily than plain bone-dust,—just as bones dissolved in sulphuric acid have a quicker action on the young turnip plants than undissolved bones.

Lime is another most useful application to pastures. It may be applied as quicklime—slaked, of course—or made into a compost with six or eight times its bulk of earth. In the former case the ground must be thoroughly bush-harrowed after the lime has been spread, and in the latter the compost ought to be made up at least two or three months before it is put on the land, and the heap frequently turned during that time. We have found 3 or 4 cwt. per acre of coarse salt in a lime compost of this kind prove a valuable addition. Salt, indeed, by itself, is a useful top-dressing for coarse pastures, strewn broadcast over the surface at the rate of from 4 to 6 cwt. per acre. We have experienced so much advantage from the use of lime, both in a quick state and also in a compost with earth, that we feel every confidence in recommending its use as a

top-dressing for pastures. Some years ago a friend asked our opinion regarding his grass-land, which was rapidly degenerating as pasture, although tolerably well laid down some years before, in so far at least as manure—farmyard and town dung—was concerned. The pasture had been very good for some time, but its feeding powers had fallen off, and it was becoming fogged. It would not have suited him to break it up, and we advised him to give it a dose of quicklime. The soil was a tolerably strong loam. There is a strong prejudice in the district in which our friend's place was situated against the use of lime, and he shared in the general dislike; but we succeeded in persuading him to try one field, the worst on the place, and the consequence was an improvement in the quality of the pasture which appeared to him and others almost marvellous. The surface became covered with a thick growth of white clover and cow-grass, while other natural grasses of considerable value also reappeared. So satisfied was our friend with the result that he had some more of his grass-land top-dressed in the same manner, and it was only his sudden death which prevented the entire farm from being similarly treated.

Where old pasture exists in connection with a tillage farm on which turnips are grown, a simple plan of improving it is to draw a proportion of the turnip crop and scatter the roots over the grass-land, for the purpose of being consumed by sheep. Begin at one side of the field and scatter the turnips thinly, then move to a fresh spot next day, and so on, day by day, until the whole field has been gone over. If necessary, and turnips abundant, go over it a second time in the same way, and it will be found that a very great improvement is usually the result.

But it sometimes happens that there is no tillage-land in connection with the pasture, and even that turnips cannot be purchased for the purpose of being consumed on the land in the manner described. Another plan must therefore be resorted to in such cases; and in oilcake and other kinds of artificial food, among which we class grain, we have material which, when converted into manure by passing first through the stomachs of a flock of sheep, serves to enrich the soil and improve the pasture in a marked manner. We are personally cognisant of a case where the yield of grass was increased 220 per cent in consequence of folding sheep on old grass-land, and feeding them with oilcake. The sheep were folded during three successive winters and fed in this manner, when it was found that the land had reached the maximum amount it was capable of producing, and the folding system was discontinued. The results were all the more easily ascertained from the circumstance that the grass was mown every year and made into hay. Other cases have repeatedly come under our notice, as well as those which have occurred in our own practice, where pasture has been vastly improved by the consumption of artificial food by sheep confined to the fields, the

entire area being gone over in consequence of the sheep being netted on the ground, just as they would be on turnips. The position of the boxes containing the food requires to be altered daily; and the nets are also shifted once the space enclosed by them has been all manured. Crushed beans, and crushed oats and barley mixed with chopped hay or straw and oilcake, have been the food we have used for sheep on grass, and we believe the improvement of the grass repaid the outlay, putting the improvement which took place in the sheep out of the question.

A very excellent paper was read by Mr Owen Wallis, of Overstone Grange, Northamptonshire, at a monthly meeting of the London Farmers' Club, in 1861, on the 'Summer-Feeding of Stock.' Mr Wallis advocated the use of cake in the case of cattle on grass, his object being to show how the meat markets might be better supplied than they are under the ordinary system of summer-feeding. The improvement of the land by the use of cattle, &c., was only alluded to by him in passing, but strong testimony was borne to it by different speakers in the course of the discussion which followed the reading of Mr Wallis's paper. Thus Mr Fisher Hobbs, referring to the improvement of grass-lands, said—

"He concurred in the opinion that the use of oilcake was a very good means of carrying out that object. He had, like many other gentlemen, seen land doubled, and more than doubled, in value, in consequence of oilcake to a fair extent having been given to beasts during the summer months. He knew many pastures in this country which would at one time scarcely maintain a fair amount of store stock; oilcake, however, having been used, it was found that animals fed with grass fattened very well, and within five years at least ten per cent more animals were fattened upon those very pastures. He was persuaded that oilcake was a simple and comparatively inexpensive mode of improving the grass-lands of this country, and of making lands which were previously store pastures, with good management, fattening pastures. He was sure that many graziers would bear him out in this opinion."

Another gentleman who took part in the discussion, Mr Little, stated that "he had reared young stock from time to time on inferior pasture-lands, and had found that, by the use of oilcake and other artificial food, the land had been improved in quality, and had enabled him to increase the quantity of stock by nearly one-half." In the course of his observations Mr Little referred to a farm near Bristol, formerly held by Mr Proctor, a well-known manufacturer of artificial manures, but now in the occupancy of Mr Richard Stratton, equally well known in his particular walk, that of a breeder of shorthorns. The pastures on that farm had been much improved, it appears, by the system followed by Mr Proctor. That system, according to Mr Little's statement, was, "after draining, to add artificial manures, and to feed his beasts with large quantities of cake; and he was certain that there was no one who had seen that gentleman's land but would approve of the system. The pastures of this

farm were of the very poorest description, but were so much improved by Mr Proctor, that on relinquishing it, which from ill-health he was compelled to do, it was taken by Mr Richard Stratton, and the Broad-Hinton herd of shorthorns are now grazing there." We think it is unnecessary to add any further testimony to the benefits derived both with regard to the improvement of the pastures and the stock which arises from the use of cake and other varieties of artificial food consumed by the stock while grazing on the pastures.

Messrs Lawes and Gilbert have published, in vols. xix. and xx. of the 'Journal of the Royal Agricultural Society of England,' the details and results of a most elaborate series of experiments conducted by them at Rothamsted during the years 1856, 1857, and 1858, with a variety of manures, for the purpose of ascertaining the comparative effect of each on "permanent meadow-land." The land selected for the experiments comprised about 6 acres of the Park at Rothamsted, which had been under grass for more than a century; and in order to test the manures, the produce of each plot was made into hay. The points to which the attention of Messrs Lawes and Gilbert was directed, in connection with the different manures used by them, were (1) their comparative effect on the produce of hay per acre; (2) the acreage quantities of certain constituents, or classes of constituents, obtained by the different manures, in order to ascertain what amounts of the several constituents are taken from an acre of land in an ordinary crop of hay; what is the drain of them which the stores of the soil, or the supplies of other manures, are called upon to meet, when the produce is increased by means of active portable manures; and, further, the proportion of the active manurial constituent, nitrogen, supplied in such manures—that is, recovered in the increase of crop obtained by its use. The next (3) point was a description of the plants developed by different manures in the mixed herbage of a permanent grass-crop, and the recognised comparative qualities of the different plants so developed. This forms a most important and interesting branch of the inquiry. Lastly (4), the influence of the different manures, where the chemical composition of the hay was investigated in the most minute manner with reference to the dry matter of the hay grown on the different plots; the total mineral matter per cent of the constituents of that matter, or ash; the influence of the manures, and of the seasons on it; the percentage, respectively, of nitrogen, cellular or woody matter, and fatty matter contained in the hay. The inquiry was altogether of an exceedingly elaborate and intricate nature, and the reports given by Messrs Lawes and Gilbert will amply repay those who study them carefully. It is quite impossible that we could give even a summary of the various branches of the Rothamsted experiments, but we may be permitted to state briefly some of the practical conclusions derived from those experiments.

With reference to the action of farmyard dung as a manure for permanent meadow-land, where the crops are annually converted into hay, it is stated that—

“The evidence regarding the action of farmyard manure goes to show that, though it is doubtless a very complete and important restorer of both the mineral constituents and the nitrogen required to repair the exhaustion of this most greedy crop [hay], yet the amount of these constituents supplied by its means is proportionally much less active within a given time than that provided in the artificial combinations. As, however, permanent meadow-land, especially when attached to an arable farm, does not, as practice goes, so much as a matter of course, come in for a due periodic supply of farmyard manure as does the land under rotation, it becomes far more necessary in its case to bestow special consideration that the mineral constituents be not exhausted, than in that of rotation crops under ordinary good management. In fact, the grass-land of the arable farm is but too frequently looked upon as the legitimate sphere for robbery for the other crops. Indeed, considering the nature of the exhaustion of permanent grass-land generally, when mown for hay, and at the same time bearing in mind the character of the artificial manures which are, in point of economy, at the command of the farmer, it would seem that the *permanent* condition of such land should be kept up by farmyard manure, stable dung, town manures, and the like, and the *active growth* aided, year by year, by the so-called artificial, nitrogenous—or, better still, nitrogenous and phosphatic manures. Where hay is grown for the supply of a town, the (in the above sense) permanent condition of the land is very generally maintained by town manures of some kind, brought by the return carriage. But where hay is grown on an arable farm, and is mown for consumption by the stock (or, still worse, for sale), the return is but too often by no means complete.”

The foregoing remarks do not apply to any general feature in Scotch farming, but our readers elsewhere will fully appreciate their practical value. Some of the finest grass-lands in the kingdom have been ruined by having a succession of hay crops taken off them, without any attempt having been made to maintain their fertility by top-dressings with farm dung, or any other manurial application; nor does the practice, which prevails in several grass districts, of mowing and grazing in alternate years without manuring, differ much in the ultimate results. It is merely procrastinating the exhaustion of the land, not preventing it.

Messrs Lawes and Gilbert recommend, as “a very generally useful top-dressing for the hay crop,” a mixture composed of “3 parts Peruvian guano, 1 part nitrate of soda, and 1 part sulphate of ammonia. Of this mixture,” they say, “2 to 2½ cwt. per acre may be employed. With this applied annually, and the application of 10 or 12 tons per acre of poor (*sic*) rotten dung once every four or five years, a good crop of hay may be taken off every year without injury to the land. The best time of sowing the artificial manures is generally in January, and it should at any rate be seldom postponed beyond February.” With regard, however, to the effects of manures in another point of view—that is, on the nature of the herbage developed by the different substances which were used—an important

point was brought out in a subsequent part of the inquiry—viz., that ammoniacal salts tended to *deteriorate* the character of the produce, “both in regard to its *condition*, and to the *description* of the grasses that were developed;” that the addition of ammoniacal salts, especially when used in excessive amount, produced a larger proportion of “weedy herbage,” and fewer “grasses of recognised sound quality.” Peruvian guano, in which there is a large percentage of ammonia, must therefore have the effect of developing the growth of the inferior qualities of herbage, especially when applied in conjunction with sulphate of ammonia. The foregoing mixture can scarcely be regarded, therefore, as a suitable top-dressing in the case of weedy pastures, which, in fact, form a very large proportion of the permanent grass-lands met with in many parts of the kingdom.

At the very time when Messrs Lawes and Gilbert were conducting their experiments on permanent meadow-land at Rothamsted, Mr Porter was engaged in somewhat similar researches at Monymusk, in Aberdeenshire, the results of which were communicated by him to the Highland and Agricultural Society, and were inserted in its ‘Transactions’ for 1861. Mr Porter’s experiments were conducted on a level field, of good alluvial soil, which had been at least forty years in grass. No extra manure had been applied during that period, with the exception of a dressing of powdered lime, which had been applied twenty-five years before Mr Porter’s experiments were made. A good deal of moss had got into the field, and the pasture it had yielded had been of an inferior character for several years. The experimental plots were each half an acre in extent, and the cost of the manures was £2, 2s. per acre for each kind. The produce of each plot was made into hay, and the following is the order in which the different manures stood with respect to the increased value of hay per acre produced by their application:—1. Sulphate of ammonia; 2. Peruvian guano; 3. Nitrate of soda; 4. Sulphate of potash; 5. Superphosphate of lime; 6. Farm-yard dung, 12 yards per acre; 7. Earthy compost, consisting of clayey mould and cattle urine; 8. Muriate of potash; 9. Lime.

It will be observed that in this case, as well as at Rothamsted, Peruvian guano, sulphate of ammonia, and nitrate of soda stood highest in the list of materials used as top-dressings—at least in point of temporary effect; but the manure which had least effect on the hay crop produced the most lasting effects; for Mr Porter states that, where the lime was applied, its good effects were becoming quite apparent about two months after the removal of the hay crop, the moss being considerably decayed, the surface feeling much firmer to the foot, white clover sprouting up thickly, and the whole surface appearing greener and firmer than that of any of the other plots. Mr Porter expressed his expectations that the good effects of the lime would become still more visible as it sank in the soil; and we feel assured that his expectations on this point have been fully

realised. Mr Porter made some remarks in the course of his Report so much to the point, and so entirely in accordance with our own experience, as detailed in the foregoing pages, that we cannot refrain from quoting them:—

“For pasture-land, particularly where the soil is rich in vegetable matter and inclined to clay, powdered lime has the most powerful effect in renovating the grass of any substance I have ever tried. It at once cleans the surface, kills insects, decomposes decaying vegetable matter, and raises a close sward of sweet nutritive grasses, including considerable quantities of white clover; and cattle will prefer the grass growing on limed land. Light dressings, and repeated when necessary, is perhaps the best way to apply lime. I found two tons an acre to be perfectly sufficient; and the autumn or winter months will no doubt be the best time for applying it to the land. Where the land is much infested with moss, it will not, perhaps, extirpate it entirely, but it destroys it more than any other manure I have tried, and thereby prevents its choking the grasses—at least for a good many years after.”

Where the land is of a different description—that is, of a light, gravelly nature, and deficient in vegetable matter—it is not easy to maintain permanent grass in a profitable state; and such soils must be dealt with in a different manner. Quicklime must be more sparingly applied, and in a different form from what it would be in the case of stronger soils. For light gravelly soils, therefore, Mr Porter says:—

“I have frequently found the following compost to have a good effect:—Say 20 loads of mould (the more clayey the better), 15 cwt. of quicklime, 6 bushels of bone-dust, and 4 cwt. of salt to one acre. Some years ago I dressed a good many acres with this mixture, and sowed it with hard fescue and meadow fescue grasses, one peck each [*i.e.*, 2½ lb. of hard fescue and 3½ lb. of meadow fescue], and with 2 lb. of white and 1 lb. of yellow clover to the acre. . . . The grass on the field alluded to was much improved for six or seven years, after which it gradually began to fill up with coarse grasses, and to revert to its former unprofitable state.”

There are still one or two points in connection with the improvement of permanent pastures, which we shall briefly notice before concluding this part of our subject.

The first of these is Shelter. It may be considered that this belongs more to the stock fed on the pasture than to the pasture itself; but although a most important matter in so far as the health and comfort of the stock are concerned, it has also an intimate relation to the productiveness of the pastures. Cold unsheltered pastures are of tardy growth in spring, and decay soon in the latter part of the year; neither can the finer descriptions of grasses thrive under such circumstances. Good thick hedges are of great service in furnishing shelter; but in open districts the greatest advantage will be found in masses of plantation. These pay well for the ground they occupy, when properly taken care of; and the shelter afforded by them assists in converting bleak moorlands into fertile corn-fields and valuable pastures. That this is no mere random assertion is

well known ; and the advantages of shelter afforded by plantations are generally pretty well appreciated by Scotch hill-farmers, although they cannot always get their wishes realised in this matter. Still, we have known cases where hill-farmers have succeeded by insisting on clauses being inserted in their leases binding their landlords to plant a certain number of acres on their farms, solely for the purpose of obtaining shelter for their stock. In other parts of the kingdom, even where shelter is much required, its advantages do not appear to be understood or appreciated either by landlords or tenants. It is a subject, however, which deserves their most serious consideration, but it is too extensive in its bearings to permit us to do more at present than merely point out its importance.

A rough and unsightly state of pasture-land is produced by allowing the droppings of cattle and horses to remain where they fall. The grass, after a time, grows with greater luxuriance than on the rest of the field, but it is not relished by stock, who leave it untouched even when the rest of the field is quite bare. We have been in the habit of sending boys through the pastures, each provided with a rough club, and with this they knocked the droppings about, by which means the grass was prevented from growing in the manner described, and the ground in the vicinity of the place where the droppings lay got a sort of top-dressing. But we consider the better plan is to have those droppings regularly gathered, and carried to a convenient spot in a corner of the field, where they are mixed up, as gathered, with mould, thus forming a compost, which, if turned over two or three times, will be found more useful to the field when applied during winter as a top-dressing.

We have often doubted the propriety of waging war against moles, as we find done in many parts of the country. They are troublesome, no doubt, in gardens and tillage-fields, but the heaps of fine mould thrown up by them serve very well as a top-dressing for grass-lands. We have had those heaps regularly scattered, and the land bush-harrowed and heavily rolled with a Crosskill, and we do think the land was all the better of it. Ant-hills are much more troublesome, as those know to their cost who may have happened to sit down on one in a hay-field. Scattering the heaps, and at the same time throwing a shovelful of quicklime on the spot, will help to get rid of these industrious but not very pleasant little insects. Weeds, of course, such as thistles, ragworts, nettles, docks, &c., will not be allowed to disfigure pastures wherever the slightest attention is paid to keeping grass-lands in proper condition. Cutting thistles frequently when young will so weaken their growth that they will ultimately die out if this is persevered in. Nettles and docks must be dug out, and ragworts should be pulled at an early stage of their growth, at a time when the land has been softened by rain. Pasturing sheep seems, however, the most effectual plan for destroying ragworts,—at least we have seldom, if ever, seen much of them

on farms where sheep are kept as a regular part of the stock. Some years ago, a considerable tract of pasture-land came into our hands, which had been grazed upon by dairy cows for several years, and the whole surface was a perfect forest of ragworts. We put on a stock of sheep, and in a short time the ragworts entirely disappeared. Ragworts and thistles are to be found both in English and Scotch pastures; but to see ragworts in perfection one must travel through Ulster, in many parts of which it might almost be supposed they were the objects of special cultivation, from the closeness and luxuriance of their growth. Sheep, we may remark, rarely form part of the stock kept by the small farmers of that province. In other parts of Ireland, thistles appear to prevail chiefly in the pastures; and although the Irish Registrar-General issues an annual manifesto against their continuance, they are still permitted to occupy the land,—to such an extent, indeed, that the shamrock might very properly be entwined with the thistle as a national emblem of the “Emerald Isle.”

There is one description of permanent pasture prevalent in Scotland to a large extent, and which must always remain as such; we mean the mountain pastures. These are also found to some extent in the northern parts of England; they abound in Wales, and considerable tracts of a similar nature exist in Ireland. Their improvement is to some extent limited, but that they can be very considerably improved is a well-known fact, already acted upon to a great extent in the case of the Scotch mountain grass-lands.

The first step is draining, for, in general, mountain pastures suffer from a superabundance of moisture, both with respect to the nature of the herbage produced and the health of the stock. The draining of grass-lands of this description is, however, a much more simple and less expensive affair than the draining of low-lying pastures, single drains costing for cutting one penny to twopence per seven yards; but it is nevertheless effective, and where practised, has been found productive of the greatest benefit. Some good prize-reports on this subject have appeared in the ‘Transactions of the Highland Society;’ but we shall content ourselves at present with making one quotation from the report of Mr Latham, Aberchelder, Inverness-shire, because it alone is sufficient to indicate the advantages resulting from the surface drainage of mountain pastures. Referring to rot in sheep, Mr Latham says: “Striking instances of the cause and cure of this disease have come under my observation of late years. On an adjoining farm its ravages were very serious previous to the marshy ground being drained; but as soon as this was accomplished, the rot gradually disappeared, and the sheep became, under careful management, a sound and superior stock. Here, however, after being open for thirteen or fourteen years, these drains, which were cut much too shallow at first, are gradually filling up, and the rot has returned.”

Periodically burning the heath, bent, and other mountain grasses, when in a withered state, during the early spring months, materially improves the pasture, and, although Cockney sportsmen do not think so, is quite as much in favour of grouse as it is of sheep. It is often done carelessly, no doubt, but that is no argument against it when it is judiciously gone about.

Shelter, as we have already mentioned, is an important matter in connection with mountain grazings; and although it is not easy to enclose some large sheep-farms, yet whenever it can be done, wire-fencing should be put up, as the stock not only lie more quietly than they can do in an open run, but the grass is more regularly eaten, and the coarser parts of the grazings can be separated from those which are of a superior nature, and stocked accordingly. We know several ranges of mountain sheep-pasture where wire-fencing has been carried out to a great extent during the last twenty years, and with much satisfaction to the flock-owners.

A large proportion of our mountain pastures are inaccessible to wheeled vehicles, and for that reason cannot be top-dressed with any heavy materials which require to be carted; still there are many spots on hill-farms which can be dressed with lime after being drained, if draining is requisite; and it is a question which remains to be solved, how far the finer and more accessible portions of hill-pasture would repay the application of artificial manures, such as bone-dust, &c., either applied in their ordinary state or in compost. One thing is certain, that a considerable proportion of our mountain grazings could be improved to a much greater extent than has as yet been attempted, or even considered necessary; but this, like the improvements which have been already made, will require time even to render the idea of them familiar to the minds of those who are most interested in the matter. Some one, more forward than his neighbours, will make a beginning, the results will be seen, and the practice will almost all at once become universal. It was so with surface-draining; it has been the case, to a considerable extent, with fencing; and the principle will hold good in other matters which, as yet, are not dreamt of in the philosophy of our hill-farmers.

We now come to the second division of our subject—Pastures which form part of a regular rotation; and although this division differs in some respects from the former, yet many of the principles which apply to that which we have considered are just as necessary to insure success in that to which we are now about to direct our attention. The land must be dry, in good heart, and grasses suitable for the purpose must be selected for sowing.

The Scotch system of cultivation comprises two years', or at most three years', grass. In some cases the first crop is mown and made into hay, while in others only a portion of the crop is applied to this purpose, as much as possible being reserved for the pasture

of sheep and beasts. Now, we are free to confess that the grass break in the rotation is not uncommonly a weak point in Scotch farm-practice; and where such is the case we generally find that a sufficient variety and quantity of seeds has not been sown. Many use only clover and common ryegrass, and do not appear to consider that any other grasses are admissible among those suitable for the short period the land is under pasture in the course of alternate husbandry. This, we think, is a mistake; and we know from our own experience of a short rotation, that considerable improvement may be effected in the character of the pasture division, by sowing a more extensive mixture of seeds than is usually done. Mr Stephens very justly remarks, with reference to this point, that "the improvement of pasture of two or three years' standing, not permanent pastures, has received less attention from farmers than it deserves." In ordinary circumstances, a bushel of ryegrass and 12 lb. of clover seeds, 8 to 10 lb. of red, and 2 to 4 lb. of white, is a common allowance. This is occasionally varied; Mr Sanderson, for instance, gives, in his report of the 'Agriculture of Berwickshire and Roxburghshire' ('Transactions of the Highland and Agricultural Society,' 1862), the following mixtures, as used by some farmers in that part of Scotland:—White clover, 6 lb.; yellow do., 4 lb.; alsike do., 2 lb.; ribgrass, 2 lb.; and from three-fourths to one bushel of perennial ryegrass. Again, two-thirds of a bushel of perennial ryegrass and Italian mixed, 2 lb. of alsike clover, 4 lb. of white, and 4 lb. of cowgrass. Again, 6 lb. of white clover, 4 lb. of yellow, 4 lb. of red, and 1 lb., says the Report, of perennial ryegrass, but this is likely a misprint for 1 bushel.

We consider that where good pasture is an object—and variety of suitable grasses is a great point in good pasture—some other kinds of grasses might be introduced with advantage. Cocksfoot, for instance, produces a large amount of early feed, and timothy, in like manner, ought to find a place in grass mixtures for two or three years' pasture, especially on strong, and perhaps rather damp, soils. The great objection is, that it is not easy to get rid of it when the lea is broken up. Still it has considerable advantages, and in due proportion is certainly useful. It is not quite so early as cocksfoot, but this point is rather in its favour, as it thereby tends to keep up a freshness in the pasture by the comparative tardiness of its growth. Then Italian ryegrass gives plenty of keep at an early period, and possesses the quality of rapid growth after being eaten down or mown. A mixture of some of the best varieties of perennial ryegrass with the clovers and other grasses makes up for the bunchy habit of growth which characterises the Italian variety, and which would impart a thin appearance to pastures were Italian ryegrass to form a leading feature in whatever seeds were sown. Ribgrass is not certainly of great value, but a little of it is useful, especially in the early part of the season. Some years ago we sowed parsley,

along with other grasses, on a field of sharp loam, which we intended for sheep pasture, and so much were we impressed with its utility, from the avidity with which we saw it sought for by the sheep, that it has continued to be a favourite of ours ever since, where sheep pasture is the object. It does not last above two years, unless allowed to perfect its seeds; but while it does last, it serves the purpose for which it is intended remarkably well.

The mixture per acre recommended by the Messrs Lawson (and there is no better authority) for one year's hay and one year's pasture, on medium soils, is as follows:—Cocksfoot, 2 lb.; Italian ryegrass, 9 lb.; perennial ryegrass, 15 lb.; yellow clover, 1 lb.; timothy, 2 lb.; alsike clover, 2 lb.; red clover, 4 lb.; cowgrass, 2 lb.; white clover, 4 lb.—total, 36 lb. an acre; but when an additional year's pasture is contemplated, the quantity of cowgrass is doubled—that is, 4 lb. an acre is allowed. They also recommend that 1 lb. per acre of parsley shall be sown in sheep pastures, and in upland districts 2 lb. to 3 lb. per acre of ribgrass, and double the quantity of yellow clover mentioned above. Also, that where soils are very heavy, or of a peaty nature, the quantity of timothy may be increased to 3 lb. or 3½ lb. per acre. Hard fescue should also be sown when the grass is intended to last three years.

With regard to the improvement of pastures comprised within the limits of an ordinary rotation, the principal feature must be manuring them in some shape or other. We have seen young grasses top-dressed with about 10 tons per acre of well-rotted farmyard manure, immediately after the removal of the corn crop—barley, for instance—along with which the grass seeds had been sown. Some give this manuring to the land after the removal of a crop of turnips grown chiefly on artificial manure, and just before ploughing the land for barley or spring wheat; but where the land is in high condition, and been kept in high condition for a long period, this prior dressing would tend to produce not quite so good a sample of malting barley, and therefore the top-dressing was deferred until the barley crop was reaped. The result was an immense bulk of keep, which came in just when it was much wanted—namely, for the use of ewes suckling early-dropped lambs.

The practice of folding sheep upon turnips has done an immensity of good in enriching certain classes of soils, but it is not suited for all circumstances, as there are soils which sheep would injure rather than benefit by treading. In such cases, the proportion of turnips which it is intended shall be allowed for the sheep should be drawn from the place where the turnips were grown, early in winter, and stored in a corner of the grass-fields, being protected from depredations on the part of the sheep by hurdles or nets. A sufficient quantity should then be taken from the heaps daily, and scattered on the grass for the use of the sheep; and this, with the grain and cake given in the case of young and fattening sheep, will

lead to the enrichment of the land and the improvement of the pastures, as well as of the succeeding crop of oats. We have known land, naturally of an inferior character, and at one time very much out of heart, keep fully six shearling wethers to the imperial acre for the summer half-year, during the second rotation that a system of this kind was followed.

We have alluded to Mr Porter's experiments and Report to the Highland and Agricultural Society; and one part of his investigation was directed to top-dressing pasture-land under cultivation. He recommends, as the result of repeated trials, the application of about thirty shillings' worth per acre of light manures, formed by the combination of guano, sulphate of ammonia, nitrate of soda and soot, as the most remunerative top-dressings which can be applied to pasture-lands on strong soils under cultivation. The manures to be sown about the middle of March, we should feel inclined to sow earlier—at least in an earlier climate than Aberdeenshire enjoys. The weather must be rainy, otherwise the application will fail in a great measure. Those manures he does not consider, however, as suitable for light lands on gravelly subsoils, and recommends instead a well-made compost of bones, urine, vegetable mould, and salt; or, when the materials can be procured—that is, in the vicinity of the sea—of a compost made up of sea-weed and fish-refuse, with mould and cattle urine—"say 12 loads of mould, 4 loads of sea-weed, 1 load of fish-refuse, and 2 tons of cattle urine," which makes "an excellent and substantial dressing for one acre of light land;" and "when laid on during the winter months," he says, "its good effects on the grass in spring are all but certain."

There is just one additional point in connection with this department of the subject to which we shall allude—namely, the advantage of frequently using a heavy roller on the grass, commencing as soon as the corn crop is removed, with which the grasses are sown, repeating the operation at a later period of the season, and again in spring, taking care to do so when there is a certain degree of dampness in the land. This will be found to improve the sward materially.

The noble President of the Highland and Agricultural Society, in the course of his excellent address at Kelso, told us that "the cultivation of the grasses was a point in agriculture which remained to be developed, and in which the greatest improvements may yet take place." His Grace was undoubtedly right, for we have still much to learn, not only with regard to the grasses themselves, but also with respect to the most profitable manner in which they can be converted into meat for the million. Meat production has become the leading feature of British farming, and to it corn-growing, as well as root and grass cultivation, must become subservient. Our old ideas on this point are getting upset, and we are apt to get confused, because we cannot dovetail former ideas and practices with

the growing requirements of the farmer's customers. A good number appear to imagine that an extension of pasture and an increase of stock are synonymous terms; and that to "plough less and graze more" is the perfection of farming practice. It is natural, we grant, that such a feeling as this should exist under present circumstances, but we candidly believe that it will not be lasting or universal. We are rather inclined to think that, with more enlarged ideas, it will be changed for "plough more that we may graze more,"—that it will be seen, in short, that as there is a good deal of food wasted in carrying out the pasturage system, it is the obvious interest of people to prevent that waste, at least as far as possible, by more economical modes of using the food employed in feeding stock; and in order to show what we believe must become ere long a principal feature in farm management, we shall conclude with a quotation from that author to whom the Duke of Argyll so frequently alluded in his speech at Kelso—we mean Mr Wilson, of Edington Mains:—

"The temperate climate of Britain is so peculiarly favourable to the growth of the grasses and other pasture-plants, and to the keeping of live stock with safety in the open fields for a large part of the year, that the practice of consuming these crops by depasturing has hitherto been decidedly preferred to soiling. There is now, however, a growing conviction among agriculturists that it is more convenient to keep neat cattle and horses during summer in yards or loose-boxes, and to feed them with succulent forage mown and brought to them daily as it is needed, than to turn them adrift to browse in the fields. The pasturing plan is preferred by many, because it involves the least labour, and is alleged to be more healthful to the animals. In behalf of the soiling plan, it is urged that a given space of ground under green crop keeps nearly twice as much stock when its produce is mown and consumed elsewhere, than when it is constantly nibbled and trodden upon; that housed cattle, being exempted from the vicissitudes of the weather, the attacks of insects, mutual disturbance, and the labour of gathering their food, eat less, and yet fatten more rapidly than they do at pasture; that more good is gotten of their excrements when mixed with litter and trodden down under cover, than when dropped about in the open fields; and that land from which a green crop has been mown, when ploughed up, is freer of weeds, and (other things being equal) bears a better corn crop than that which has been pastured. It is a further recommendation to the soiling plan, that it admits of oilcake or meal being administered along with green food, with a precision and economy that are unattainable in the pasture-fields. There being so many and such cogent reasons in favour of the practice of soiling, we may warrantably anticipate that it will in future be much more generally adopted."

THE INFLUENCE OF THE ATMOSPHERE ON VEGETATION AND ON THE RENOVATION OF THE FERTILITY OF THE SOIL.

BY AN OLD NORFOLK FARMER.

THE all-pervading pressure of the atmosphere which surrounds the globe is one of the most wonderful provisions of "the Great First Cause" for the existence and welfare of the beings He has created. It is the life and breath of the animal and vegetable kingdoms, without which neither could exist, and with which, in its purity, both can sustain life under circumstances the most difficult. There is no place so confined that the atmosphere cannot penetrate into it; and no sooner has a body of matter, whether liquid or solid, aqueous or mineral, vacated its place, than the atmosphere rushes in and occupies the space. Air may be vitiated in a variety of ways, so as to be rendered unfit for respiration. It may become poisonous or noxious to such a degree that it will destroy the life of either animals or vegetables, or it may be rarified so intensely as to be equally injurious and destructive of life as if it were poisoned. But no instance has ever been recorded in which the air has been naturally excluded from any part of the world. "Nature abhors a vacuum,"* and in no instance has it been produced otherwise than by artificial means. The slightest fracture in the vehicle in which it has been sustained allows the air to rush in, by which the equilibrium is restored, and the vacuum destroyed.

The ancients considered atmospheric air as a simple homogeneous substance; nor was their idea disproved until Priestley and Scheele found means to analyse it, and prove that it was compounded of two gaseous substances, oxygen and nitrogen, in the proportion of 20.8 per cent oxygen, and 79.2 per cent of nitrogen or azote. A very small proportion of carbonic acid—not more perhaps than one part or volume to two thousand volumes of atmospheric air—has since been detected. Small, however, as this proportion appears, it plays an important part in the action of the atmosphere upon both animal and vegetable life. It has, however, been proved by experiments in widely different parts of the world, that where-

* This was an axiom with the ancient philosophers until the time of Galileo and Torricelli, who are considered to have exploded the doctrine. Galileo founded his theory upon the fact that water cannot be raised in the tube of a pump above the height of 32 feet, and that by continuing to pump, the space in the tube above that height is exhausted of its air, and consequently a vacuum is produced. It is the same with the air-pump; but the vacuum in these experiments, as well as that of Torricelli with mercury in a tube, is *not produced by nature*, but by art, and none of them have any analogous counterpart in nature. It is true that fluids act in counterpoise with each other in proportion to their respective densities; but no example in nature can be produced in which this principle has created a vacuum, or of such a state being produced otherwise than by forcible artificial means.

ever the atmosphere is free, the above proportions are maintained. Air was collected and analysed by Saussure on Mont Blanc and at Geneva; in Spain by Marti; in France and Egypt by Berthollet; on the Andes and on the top of Teneriffe by Humboldt; on the coast of Guinea and in England by Davy; at an elevation of 23,000 feet and near the surface of the earth by Gay Lussac; in South America by Boussingault; at Paris by Dumas; at Berne by Brunow, &c.; and in all these cases the atmosphere has been found uniformly the same in its constituent parts.

The height of the atmosphere has of course never been positively ascertained; but, from certain indications, it has been estimated to extend forty-two miles upwards from the earth. It is dense near the surface, but becomes rarified as we ascend upwards; and at a very great elevation is unfit for respiration; yet the proportions of its component parts remain the same, except that there is a slight increase of carbonic acid; but this does not interfere with the relative proportions of the other two components.

Oxygen is an elastic body, heavier than atmospheric air in the proportion of 10.967 to 10.000. It supports combustion more intensely than common air; so that if a bottle is filled with it, and a lighted piece of wood is introduced, it will burn with great splendour. It is respirable, and slightly soluble in water.

Nitrogen, or azote, is lighter than the atmosphere in the proportion of 0.9727 to 1. It neither supports combustion nor does it sustain life, although it plays a most important part in the economy of life in both animals and vegetables.

Carbonic acid is heavier than atmospheric air in the proportion of 1.52 to 1; it can therefore be poured from one vessel into another. It is composed of carbon and oxygen. It extinguishes flame, and is destructive of life. Supposing the atmosphere to reach forty-two miles in height, the following is its proportionate volume as compared with those of oxygen and carbonic acid:—

Volume of the atmosphere,	.	.	9,307,500 cubic miles.
Do. of oxygen,	.	.	1,954,578 do.
Do. of carbonic acid,	.	.	3,867.7 do.

Ammonia is a combination of hydrogen and nitrogen. It is the last product of putrefaction in animal bodies; and when we consider that every thirty years a thousand millions of the human race, with an infinitely greater number of the inferior animals, die and are reproduced, we may readily account for the quantity of ammonia which must be contained in the atmosphere. But although we know from experiment and analysis of plants and animals, that vast quantities of ammonia are derived from the atmosphere, all the attempts of the most eminent and skilful chemists to detect it in the air by analysis have failed. Either the apparatus at present in use are not sufficiently delicate to arrest

it, or it is of so subtle and volatile a nature that it flies off before the skill of the operator is able to fix it.*

In the gaseous form, ammonia easily dissolves in water, which prevents it from accumulating in the atmosphere. Nor can it long continue there. Every shower of rain causes it to condense, and it descends with the rain to the surface of the earth. Rain-water, therefore, must always and at all times contain ammonia. The proportion varies according to the frequency and long or short continuance of the downfall. Thus, if several wet days occur in succession, the amount of ammonia is greater in the rain of the first day than in that of the succeeding ones. After a drought, too, the rain of a thunder-cloud brings down a much larger quantity than an ordinary shower. "If one pound of rain-water contains only a quarter of a grain of ammonia, then a field of 26,910 square feet must receive annually upwards of 80 lb. of ammonia, or 65 lb. of nitrogen. Now, according to Boussingault, wheat contains 2.3 per cent of nitrogen, and wheat straw 0.4 per cent. If, therefore, we reckon a crop of wheat on an acre of land to weigh 1500 lb., and the straw 3400 lb., the supply of nitrogen required to produce it will be as follows:—

1500 lb. of wheat at 2.3 per cent.,	34.5 lb.
3400 lb. of straw at 0.4 "	13.6 "
Nitrogen,	48.1 "

which is equivalent to 59.2 of ammonia. Now, in the above proportion, the quantity that descends upon an acre of ground annually is 130 lb. of ammonia, equal to 105 lb. of nitrogen.

The presence of nitrogen is not exclusively confined to the air, nor is it the production only of decaying animal matter. In the waters of the lakes at Castel Nuovo and Cherchiago, boracic acid issues out of the earth in hot steam into the water, where it is retained, and may be reduced to a crystallised form by evaporation of the water. In the process, a large proportion of ammonia is obtained. Liebig is of opinion that this ammonia has existed prior to the creation of human beings, and that it is one of the primary constituents of the globe itself. In the large chemical works at Liverpool, at which natural boracic acid is converted into borax, many hundred pounds of ammonia are obtained at the same time.† Here, then, is an ample source of ammonia, when liberated, to supply vegetation, in addition to what is evolved by the putrefaction of animal substances.

* Liebig, p. 44. This is not strictly correct, for recently ammonia has been detected in atmospheric air, but in so inappreciable a quantity as scarcely to be called more than "traces;" and it is questionable whether even this, *as ammonia*, formed a constituent, or was only accidentally present. More experiments are wanted to establish this point.

† Liebig's 'Agricultural Chemistry,' p. 80.

Besides the substances enumerated, the air is frequently mingled with various gaseous substances, derived from artificial sources—as gas-works, common sewers, and other works in which decomposition, either natural or forced, is going on. These are purified in the laboratory of nature by means of oxygen, which combines with all the elements.

Moisture or water is one of the constituents of the atmosphere in one form or another. It is composed of 85 per cent of oxygen, and 15 per cent of hydrogen; and these elements, in a state of combination more or less dense, are found in abundance in the form of clouds or mist, from whence, under certain conditions, they descend to the earth as rain, hail, snow, and dew. The quantity held in suspension in the atmosphere is much greater in hot than in cold weather, and the descent of moisture in the form of dew is much more copious in summer than in winter.

Water is subject to evaporation either by the action of heat or by its absence. A burning sun and a piercing wind equally cause evaporation. In dry, hot weather, the evaporation from the surface of the earth is very great; whilst the clouds, which would otherwise produce rain, are rarified and held in imperceptible suspension during the day—condense again at night, and fall, in the form of dew, in copious depositions upon the earth and the plants upon it. Water constitutes at least three-fourths of the weight of living animals and vegetables, and a constant supply of it is, therefore, a necessity of their existence. The fertilising substances conveyed to the earth by rain and dew are very important to agriculture. Barral, in 1853, examined the water in the rain-gauges at the Paris observatory, and discovered a large quantity of ammonia in it; and he proved by analysis, that not less than 24.84 lb. of nitrogen are annually brought down by rain-water on every acre of land, and that half of it is in the form of nitric acid, and the rest ammonia. This result has since been confirmed by the investigations of Boussingault, Way, and other chemists.

A frost (if severe) will evaporate water almost as rapidly as heat. We have known large rivers almost laid dry during a long-continued frost. In an undrained and ill-cultivated country; therefore, a hard frost in winter is one of the greatest blessings to exhaust the superabundant moisture in the soil: without it, the land would not be in a state to receive the seed of spring in a reasonable time—especially the clay soils. In Tartary, the inhabitants avail themselves of the power of frost in increasing evaporation, to reduce their milk to a dry powder. The milk, during a frost, is placed in shallow vessels, exposed to the east wind. In a few hours a white crust forms on the surface, which is carefully scraped off and put into a jar. Another crust soon appears, which is also taken off; and thus the process is repeated, until all the moisture of the milk is evaporated, and only this dry powder is

left. This is put into jars or bottles, and will keep any length of time. A spoonful of it has the same effect upon a cup of tea as fresh milk.

Carbon and the elements of water (oxygen and hydrogen) are the principal constituents of plants and vegetables. The leaves and other green parts absorb carbonic acid and emit oxygen in equal volume, and they possess this property quite independent of the plant itself. If, after being separated from the stem, they are placed in water containing carbonic acid, and exposed in that condition to the sun's rays, the carbonic acid is, after a time, found to have disappeared wholly from the water. The upper strata of the atmosphere contains more carbonic acid than the lower, and the entire atmosphere more in the night than in the day, when it undergoes decomposition. Plants, therefore, improve the air by the removal of carbonic acid, and the renewal of the oxygen, which is immediately applied to the use of man and animals. The cultivation of vegetables increases the healthy state of a country.

The amount of oxygen taken into the human system in one year from the atmosphere, according to Lavoisier, is 746 lb., and, according to Menzies, 837 lb. No part of this large quantity is retained in the system, it being given out in the form of compounds with carbon and hydrogen. "All living creatures," says Liebig, "whose existence depends on the absorption of oxygen, possess within themselves a source of heat independent of surrounding objects. The truth of this applies to all animals in existence, to the germination of seeds of plants, and to the flowering and maturation of fruits."

We find, then, the following elementary matters contained in the atmosphere, two of which only are permanent in their relative proportions—namely, oxygen and nitrogen; whilst carbon, hydrogen, and ammonia are constantly fluctuating in their proportions: these are termed the organic constituents of plants. We must next endeavour to show the relative connection between these elements and the soil and plants growing in it. Before, however, entering upon this, we shall enumerate the mineral or inorganic constituents which enter into the composition of plants, being found in their ashes in minute quantities. These are:—

Magnesium.	Silicon.
Calcium.	Phosphorus.
Manganese.	Sulphur.
Iron.	Chlorine.
Aluminium.	Iodine.
Sodium.	Bromine.
Potassium.	Fluorine.

The combinations formed by these constituents are of two kinds—mechanical and chemical; the difference between which is thus

described by Sibson, in his work on Agricultural Chemistry:—
 “In a mechanical mixture, each constituent remains unaltered in its essential character, and may generally be recognised in the mixture with the naked eye, or by a microscope, and, in most cases, may be removed from the mixture by mechanical means; and, further, when separated, will be found in the same condition as it was before it was added. The appearance and external properties of a mixture are regulated by those of its constituents. On the contrary, in chemical combinations—or, as it is called, a compound—one substance, at least, is essentially altered; and by no amount of examination by the naked eye, or by the microscope, can the constituent particles be detected. Hence the smallest particle is of the same quality as the bulk of the substance, the whole being perfectly uniform and homogeneous. Moreover, the qualities of compounds are not regulated by those of their constituents. Liquids may produce solids; gases may produce liquids; poisons may be formed from innoxious substances; so that no opinion can be formed of the character of a compound by judging of the qualities of its constituents. A few examples will render this more intelligible. When chalk is powdered and mixed with water, a creamy liquid results, possessing qualities intermediate between those of chalk and water. On standing, the chalk settles to the bottom, and the clear water is the same as before the experiment. If, instead of chalk, we use plaster of Paris, the creamy liquid, in this case, will harden quickly, and finally become a solid mass; the water will disappear, and no longer be perceptible by the properties it exhibits in a liquid form. In this latter case the materials employed have combined chemically. Again: Gunpowder is a mechanical mixture, although a most intimate one. It consists of charcoal, sulphur, and saltpetre. By washing in water the nitre is dissolved, and now can be easily removed and separated from the other ingredients by filtering and straining. The nitre may be obtained in a solid form by evaporating or boiling away the clear liquid over a lamp or fire until it dries up. The two other constituents may also be separated by suitable means not necessary to describe here. Each constituent thus separated from gunpowder will be found in precisely the same condition, as regards its chemical character, as before being manufactured. But all know that if fire be applied to gunpowder it is instantly consumed, leaving nothing but a small residue: in other words, its constituents *have combined chemically*; and how different are the resulting compounds! Except a trace of solid matter, nothing but smoke is seen; yet these compounds, with some invisible gases, contain all the sulphur, charcoal, and nitre that existed in the gunpowder. These materials have assumed new forms, in which none of their original properties can be recognised.”

We have shown that ammonia is carried down by rain and dew

in a soluble state, and that when it enters the soil it is immediately separated and fixed by the earth, to form the pabulum of plants. This separation is effected by a chemical attraction in the soil, but the mode, or the mineral agents employed, is one of the secrets of Nature. It has been proved, by passing water charged with ammonia through a body of earth, that, when again analysed, it was wholly divested of the ammonia.

It is equally an open question whether plants receive their mineral nourishment by the roots in a liquid or in a solid form—whether in a minutely comminuted shape, or whether it undergoes a chemical change analogous to that of food in the human stomach. No substance similar to the gastric juice has yet, that we are aware of, been discovered in the rootlets of plants; but it is possible that the roots may secrete such a juice, and that by it the fine particles of soil coming in contact with the spongioles of the roots may be dissolved, so as to enable the plant to assimilate them.

The carbon of plants is exclusively derived from the atmosphere, where, however, it only exists in the form of carbonic acid, in which it is combined with oxygen. In this form it is received and decomposed by the plants, which emit an equal volume of oxygen, and retain the carbon. That portion contained in the roots of annual plants, such as cereals and garden vegetables, remains with them in the soil, and furnishes a supply for the ensuing crop.

Light and moisture are required to enable plants to appropriate the elements of fertility through the leaves and other green parts. The beautiful process by which these functions are exercised, commences with the first formation of the leaves, and continues until the fruit is matured. Even when the leaves themselves have arrived at maturity, they still receive the same elements from the air, but they then go to assist in the formation of woody fibre and other solid parts—as sugar, amyline, starch, &c.—and acids, which were previously formed by the roots when they were necessary for the development of the stem, buds, leaves, and branches of the plant. When these are arrived at a certain stage, the supply of nourishment to the leaves is still maintained, but is now expended in the production of blossoms and fruit. When these latter are matured, and not till then, the functions of the leaves cease. They now yield to the destructive influence of the oxygen of the air, lose their verdant colour, and finally fall off.

By observing, therefore, the connection between the soil and the atmosphere—the former as the repository, and the latter as the dispensary, of the elements of fertility—what are the conditions required in the soil in order to promote and increase the supply of the substances which the atmosphere has furnished so bountifully?

The first and most obvious means is the removal of every obstacle to their admission and reception, by loosening the soil to

the depth required, to give to the roots of plants their full development. If the rain and the dew bring down with them, in a soluble state, the ammonia or nitrogen so essential to vegetation, and this substance is immediately separated on coming into contact with the soil, the looser the earth and the deeper the tillage, the more effectual will be the separation of the ammonia from the water. This will explain the impolicy of continuing to plough at the same depth of five or six inches, year after year, without touching the subsoil, or providing for the discharge of the surplus water by under-draining. In lieu of this latter, high ridges, deep furrows, and cross open drains, are resorted to, which have the effect of carrying off the water that falls, without giving it an opportunity of depositing the ammonia in the soil. And thus a large proportion of the benefit the land would derive from the rain is wholly thrown away and lost.

But this is not the only evil attending an imperfect system of tillage. By giving access to the atmosphere to the interior of the soil, the formation of carbonic acid is promoted as well as the admission of oxygen, and thus a provision of soluble substances of fertilising properties is provided, to supply the intended crop with nourishment, and render it luxuriant. These benefits are lost if the land is only half cultivated. The action of the plough-sole alone, always passing through it at the same invariable depth, is sufficient to create an effectual barrier to the admission of air, by the formation of a *pan*, hard as a rock, let the soil be what it may, except a sheer sand; and thus neither the air nor the roots of plants can penetrate beyond a certain depth, and the proportion of food supplied to them is diminished by the very process which, if properly conducted, would furnish them with the most liberal and constant supply.

The admission of the oxygen of the atmosphere is necessary to the decay of the roots and other parts of dead vegetation. The carbonic acid in these materials is absorbed by the living plants through their roots, and being replaced by oxygen from the air, the process of decay is renewed and completed, by which a further portion of carbonic acid is evolved and taken up by the plant, which, whilst growing, receives its food both from the soil by its roots, and from the atmosphere by its leaves and other organisms above ground. But as soon as these latter are matured, the necessity for the carbonic acid of the soil ceases, and they are supplied with it wholly from the atmosphere.

It will be seen, from what we have written, how important to vegetation is the aeration of the soil by perfect pulverisation, subsoiling, and thorough draining, in order to admit freely the action of the air, and the constituents of the atmosphere. By these operations the rain no sooner falls than the soil begins to filter it by divesting it of those fertilising elements which are held by it in

solution; and passing through the opened subsoil to the drains, draws after it air charged with an additional quantity of those ingredients: for wherever water penetrates, air will find its way also; and as the one is expelled or passes, the other instantly enters. By this interchange of occupancy, the heat of the atmosphere also is communicated to the interior of the soil; for it is only by actual contact, and not by radiation, that the earth can receive the caloric from the sun's rays. This heat is further augmented by the union of the oxygen with carbon in the soil, in the same manner that heat is thereby generated in a hotbed, or any other medium of fermentation. It has been proved that land that has been drained and subsoiled is two or three degrees warmer in its interior than that which remains in a state of nature, or has never received any other care than ploughing five or six inches in depth.

Liebig states that rain-water can only contain nitrogen in three forms,—“as dissolved atmospheric air, as nitric acid, or as ammonia. The nitrogen of the air cannot be made to enter into combination with any element except oxygen. We have not the slightest reason to believe that the nitrogen of the atmosphere takes part in the processes of assimilation of plants and animals. On the contrary, we know that many plants emit the nitrogen which is absorbed by their roots, either in the gaseous form, or in solution with water. But there are, on the other hand, abundant facts to show that the formation in plants of substances containing nitrogen—such as gluten, &c.—takes place in proportion to the quantity of this element conveyed to their roots in the shape of ammonia, derived from the putrefaction of animal matter.”

“Ammonia is capable of undergoing such a multitude of transformations when in contact with other bodies, that in this respect it is not inferior to water, which possesses the same properties in an eminent degree. When pure it is extremely soluble in water, and it forms soluble compounds with all the acids,” &c.*

Nitrogen is absolutely required, even in the richest soil, to bring plants to maturity—it being found to exist in every part of the vegetable structure in one form or combination or another; and the above statement explains how nature furnishes the necessary supply of that element for the formation and perfecting of the albumen, gluten, fruits, and seeds of plants. But the manner in which plants take up the nitrogen of the air is involved in mystery. Boussingault thinks that it may be either directly as a gas, or dissolved in water. Be this as it may, the quantity in plants is greater than that supplied by manure.

The influence of light and its action on vegetation is worthy of observation. Seed must be buried a certain depth in the earth,

* Liebig's 'Agricultural Chemistry.'

according to its kind, to enable it to strike its roots with vigour. Protection from the sun's rays is necessary to the full development of the germinating process. It is the same with cuttings of plants, and with those plants which require removal. Cuttings should be shaded from the sun until they have struck out their roots; and cloudy dull weather, even if no rain falls, is favourable to planting. The old saying, "Sow in dry and plant in wet weather," originates in observation of this principle. For the same reason early-sown spring corn, *as a rule*, is more productive than late-sown. The former lies longer in the soil before it appears above ground; but it is not idle during that time—it is acquiring strength of root; and whilst the straw is shorter and stiffer, the ear is fuller and longer, and the grain heavier, than those of late-sown corn. When the length of the days much exceeds that of the nights, the seeds vegetate too rapidly; and although the straw presents a florid appearance and attains great height, it possesses less vigour, is easily beaten down by storms of wind and rain, and the yield of grain is comparatively small. Add to these differences a later period of maturation, and consequently a more precarious and longer period of harvest, and the propriety of early sowing, when and where it can be done, appears plain enough. Barley sown in January is long before it makes its appearance; but, while the coldness of the atmosphere prevents the plumule or budding-stem from making much or any progress, the warmth of the interior of the soil, especially if thorough drained, protects the roots from the influence of the frost; and when the days lengthen and the sun attains a greater power, it springs up with great vigour. The best piece of barley of the season the writer ever grew was sown the beginning of February, and it ripened in July before any other corn was ready.

The above paragraph may be deemed a digression from the main subject of this paper; but it must be recollected that light acquires its power over vegetation through the medium of the atmosphere, and that heat also is generated by the action of the sun's rays on the atmosphere. This is proved by the fact that, as we ascend from the earth into a more rarified air, we find the cold increase in proportion to the height, until we arrive at a temperature under which vegetation cannot exist. Dr Herschel showed, by experiments, that there are rays transmitted from the sun which do not illuminate, and which yet produce *more heat* than the visible rays; and Sir H. Davy, who states the above fact, says: "It is certain that the rays exercise an influence (on vegetation) independent of the heat they produce. Thus plants kept in the dark in a hothouse grow luxuriantly, but they never gain their natural colours. Their leaves are white and pale, and their juices watery and peculiarly saccharine." *

* Davy's 'Elements of Agricultural Chemistry,' p. 39..

Electricity, that mysterious agent which, although never visible to the eye of man except by its effects, has become subservient to him as the swift messenger of communication between far distant countries and climes, acts a part in the promotion of vegetation, the value of which is at present but little understood. There is no doubt, with those who do understand and have investigated the subject, that this powerful atmospheric phenomenon might be made far more amenable to the cultivation of plants and vegetables by artificial means than it is in its wild and natural mode of operation. The subject is too wide a one to go into on the present occasion; but we should be glad to hear that it has been taken up seriously by men of science capable of establishing and carrying out a system so as to render it useful to agriculture. Sir H. Davy found that corn sprouted much more rapidly in water positively electrified by the voltaic instrument than in water negatively electrified. Nor is electro-culture quite an unknown art, experiments having been successfully instituted; but we are not aware that they have been followed up by the adoption of the process in the practice of the farm.

The design of the writer of this paper is rather to direct the attention of the reader to the subject than to give a scientific and systematic view of it, which the space allowed would not admit. His object is to lay down the general principles and facts he has met with in the course of his reading, in order to stimulate those interested to make further inquiry. To the agriculturist the subject is deeply important, and it will amply repay him for whatever time or trouble he may expend upon it, connected as it is with every operation of the farm.

RETROSPECTIVE NOTES ON FARM CROPS AND CROPPING.

No. I.

IN the introduction to our 'Retrospective Notes on Cattle Breeding and Feeding,' which in several numbers of this Journal we presented to our readers, we took occasion to point out how, in the past records of agricultural history, an immense amount of interesting and practically useful information is bound or locked up, so to speak, in a manner so complete and fast, that it is virtually lost to the agricultural community: and we ventured to express our belief that, in opening up these stores of knowledge, and presenting them for the easy acceptance of the readers of this Journal, we would be doing them a service in some degree valuable. Although the subject was so wide, and

the materials illustrating it were so abundant, that we only touched, as it were, its outer hem in the space of several articles ; still the result of our papers, and the way in which they were received, proved that our surmise as to their value was not altogether wrong. Indeed, it is scarcely possible to overestimate the value of the knowledge stored up in books ; and of all the sciences, agriculture is just the one most likely to be benefited by its resuscitation ; for the practice of farming is mainly an application of the results of experience. True, that science—as, for instance, that of chemistry—has in more recent times been able to eliminate many points of great practical importance, and that, therefore, it may be said that the practice of former times has become obsolete, and shows forth no point of value available for those we now live in. And, in like manner, as the results of the past history of any other branch of art, as say that of mechanics—to wit, the steam-engine—are simply matter of curiosity now, affording no information to guide the practice of the engineer of the present day ; so it may be said of agriculture that the records of past experience, however interesting, are of no practical value nowadays. But the cases, although apparently, are in reality by no means similar. The art or science of engineering deals with materials of a very different character from those with which it is the business of agriculture to interest itself ; and these materials are capable of being used in an infinite variety of ways, dependent upon increased facilities for working them, and improved modes of making them available in a widely extending practice. Not so with agriculture, if there was no other consideration than this, that she has mainly to do with “life :” in the plant and in the animal, there would be enough in it to show that there must of necessity be a degree of permanence and a continuity of practice in certain directions. Life to-day is the same as what it was years ago, and in the soil, the water, and the air, the same circumstances are met with now which claimed the care and demanded the attention of the farmer years ago. In saying this, it is not meant to convey to the reader that we do not consider the art of agriculture a progressive one : far be it from us to maintain that which would be as incorrect as it would certainly be unpopular in those days, when, glibly enough, the condition of agriculture is spoken of by some as having attained the ultimatum of perfection. We simply mean to show that there is something in the art of agriculture which perforce makes it a much more slowly progressive one than others, and, moreover, will always maintain the same general features in its practice. In some arts we see a complete subversion of practice, the material used years ago in a certain process being completely laid aside, and another substituted for it : *that* subversion we shall never see in agriculture ; harvests of waving grain will still bless

the land, and flocks and herds be sprinkled over the hills and meadows; and the raising of the one and the care of the other will be carried out very much in the same way, and be dependent completely on the same principles, years hence as now. Enough, then, has been said in this direction to prove the utility of retrospective notes on the various departments of agriculture. But further, their value is increased when we consider that, apart from taking note of what has been done in the ordinary modes of farming, they will equally embrace notices of modes apart, so to speak, and of systems of management which, successful in one district, have not been tried, or indeed have not been heard of, in another. Speculations also pointing to improved results in practice, which have been forgotten, or are now quietly being pushed forward into practice, will also be noticed; so that, without promising too much, we may be able safely to promise something interesting and valuable in the notes which we are now about to present.

Of all the crops which our fields produce, WHEAT is the most valuable and important; to this, therefore, we propose directing our first attention. This grain—the staple of man's food—has been known from time immemorial, and was doubtless given to man by his beneficent Creator as one of the things essential to his existence, and in precisely the same form as we now see it waving in our fields. Various attempts have been made to trace its origin, but these have been made with no directly practically useful results. It is natural enough that attempts should be made to trace the origin of an important plant like that of wheat, and we know that such attempts have been made from very early times. Thus the Greeks endeavoured to trace its origin; and, curiously enough, they attributed it to the grasses known as the *Ægilops*, which were very plentiful in Babylonia, Persia, and Syria, and which are now met with on the shores of the Mediterranean. This notion has been again taken up in very recent times, and has received the careful attention, in particular, of M. Esprit Fabre of Agde, who, from the result of a series of careful experiments, believed that he had produced from specimens of this grass true wheat, or plants possessing all the characteristics of true wheat. There are three species of *Ægilops* met with in the *Æ. triuncialis*, *Æ. ovata*, and *Æ. triarestata*. A fourth grass is sometimes added—the *Æ. triticoides*; so called from its possessing the glumes and other triticoid characteristics of wheat (*Triticum*). But M. Fabre has shown that this fourth grass is produced from the *Æ. ovata*; he thus retains three species, already named in his classification of *Ægilops*. If a spike of *Æ. ovata*, as ascertained by M. E. Fabre, is introduced into the ground, the four seeds of which it is composed yield in the following year four plants of *Ægilops*, distinct from each other, but with their roots interlaced so as to

form a species of tuft. Generally these seeds thus grown produce the parent plant *Æ. ovata*, but sometimes one of the seeds gives birth to a plant which bears a remarkable resemblance to the cultivated wheat, and hence the name given to it, *Ægilops triticoides*. It was this plant which M. Fabre assumed to be the origin of our wheat, and to test this he saved its seeds, and, following up the plan of sowing the seed of one year produced from the plant preceding it, and this through twelve years or generations, he produced at last a true wheat, or what he considered a true wheat; for, as he remarks, "a continued cultivation in the open fields for four successive years did not cause any change in its form, and it yielded produce similar to that of the other corn of the country." This result, or assumed result, was at once endorsed by the eminent authority, Professor Duval, of the Faculty of Sciences of Montpellier, who attributed, therefore, to M. Esprit Fabre the merit of "having discovered the true origin of wheat." "Its origin," the Professor remarked, "had, it is true, been suspected and vaguely pointed out by several persons, but the honour of a discovery is really due, not to the author of a surmise, but to him who has established the fact by observation, experiment, or reasoning, leaving no room for *further doubt*." But this further doubt *was* nevertheless held by other authorities, and exception was taken not to the experiments of M. Fabre, but as to the proof obtained from them as to the fact being established that wheat was produced from *Ægilops*. Was the *Æ. triticoides* a distinct species, or was it itself a hybrid plant? and if the latter, might it not be possible that the hybridisation was effected by a union between a plant of the *Ægilops* and of the common wheat? The idea was philosophically ingenious, and was ably followed out by M. Godron, who came to the conclusion that *Æ. triticoides* was a hybrid, and therefore it was easy to understand why its cultivation brought it to a true wheat, inasmuch as hybrids, "when fertile, tend to return, after a certain number of generations, to one of the two types which has given them birth." M. Godron showed that while *Ægilops triticoides* is never very abundant anywhere, still, *when* met with, it is usually on the borders of wheat-fields, or in their neighbourhood, and *never* in sterile places far removed from the cultivation of cereals. There is a species of wheat called *Touzelle* cultivated by the farmers of Agde, the town in the neighbourhood of which M. Fabre conducted his experiments. Now, the habits of this wheat were assumed from the first year of the cultivation of the *Ægilops triticoides*. Further, where beardless wheat is grown, the *Ægilops triticoides* has its awns almost rudimentary or beardless, while, if bearded wheat is grown in the neighbourhood, the plants of *Ægilops triticoides* are also bearded. Viewing these facts, then, Dr Godron suggests that, instead of the *Touzelle* wheat originating from *Ægilops*

ovata transformed into *Ægilops triticoides*, the *Ægilops triticoides* may be transformed from the Touzelle wheat. This is further probable when the second fact noted above is considered, since the variations in the *Ægilops triticoides*—beardless or bearded, as the case may be—are related closely to the variations of the wheat grown in the neighbourhood. But still, other circumstances point in this direction. Thus Dr Godron found that the seeds of *Ægilops triticoides* which he sowed were not productive of seeds, although of flowers; still, the seeds of other species of *Ægilops* were productive. Now, hybrids as a rule, are generally barren, or rather not fertile. Another of these circumstances pointed out by Dr Godron is an important one. The spike of *Ægilops ovata*, grown under the same circumstances, previously described as one by M. Fabre, produces two plants, *Ægilops ovata* and *Ægilops triticoides*, these two being so distinct in characterisation that no hesitation has been shown by all authorities in considering them as legitimate species. But the spike produces these two plants *only*; it never produces anything else, giving birth to no intermediate form or forms *Between the two plants*. "Hence," says Dr Godron, "we should have here a transformation always sudden, always equally striking. This pretended metamorphosis is never made by degrees, and does not require for its completion the long period of time which the devoted partisans of the variability of species suppose to be an indispensable condition. Cultivation, so powerful a modifier, has never been seen to develop in plants changes so important, and, above all, so rapid. Therefore we cannot admit that there is here a simple transformation of one species into another." Dr Godron points out that science furnishes a very simple explanation of the origin of *Ægilops triticoides*, and of the modification undergone by it in cultivating it till it approaches the condition of, and becomes almost confounded with, true wheat. The conditions of a hybrid plant are all presented by the *Ægilops triticoides*, none of them being deficient, so that it may be assumed that it is the fertilisation of *Ægilops ovata* with *Triticum vulgare*. These conditions of hybrid plants may be named here—sudden production, and linked by its character at the same time to two distinct species; influence of race and of variety upon intermediate products, accidental origin here and there marking the plants; slight development of the fecundating or fertilising action; and, finally, a tendency to resort, in the case of the fertile plants, towards the male type, this reversion taking place or being completed after the lapse of a few generations. The following, then, are the conclusions of Dr Godron:—

"1. Hybridites may occur spontaneously among the grasses, and *Ægilops triticoides* is the first known example of a hybrid observed in this family.

"2. The species of *Ægilops* must be united generically with *Triti-*

cum, which is, besides, confirmed by the shape of their *fruit*, an organ which, in the family of the grasses, furnishes far more important characters than the conformation of the *floral* envelopes.

"3. The observations of M. Fabre upon *Egilops triticoides* do not in any way prove that cultivated wheat originates from *Egilops ovata*, or that one species can be transformed into another."

We have been thus particular in going somewhat fully into the details of this subject, involving as it does some points of importance in connection with the cultivation of the cereals, *and the hybridisation of plants*.

As a good deal has of late been pointedly written and said about the development of species, we may perhaps here be permitted to remark, that there is considerable danger of erroneous scientific opinions resulting from this mode of investigation. Whatever may be said of it, it may be predicated as one of its results, that it will tend to weaken, in the mind of him who adopts it, the belief in the power, the wisdom, and the care of the Almighty. And we are oldfashioned enough to feel that this belief is too valuable to be thrown away, all the more that such a mode of investigation does not, in many cases, lead to any practically useful results. Our practice will not be a whit the less valuable in its results, because we believe, for instance, that, as God created man and woman, so He created the wheat which was to feed them, rather than that it was developed from a grass. Indeed, this development theory is replete with difficulties. Who was it who first saw with far-seeing glance this same grass carrying within it an occult value? and by whose incessant and well-directed care was it finally transformed into the life-supporting wheat? We do not trouble ourselves, in like manner, about the acorn which grows upon the oak, as to whether it was developed from something else, or from some vastly inferior plant of the same or apparently the same kind. We accept the fact of the acorn having been produced from the oak from the beginning of created life. Why not equally accept as fact that the ear of wheat has been borne upon its stem from the earliest times also? But the truth is, man is so vain, and his haughty spirit is vexed at the idea that *he* has to "live, move, and have his being" in One, and through One, the Almighty, that he is perpetually trying to prove his own independence and his own power. He is like a foolish fellow who, while in reality supported by a friend, and not worth a penny, goes boasting everywhere what great things he does, and the means he has at his command. The generous, truthful man is never ashamed to own his dependence upon, and to acknowledge his obligations to, a higher or nobler one than himself.

A writer favourably known to the readers of this Journal, 'The Old Norfolk Farmer,' has been recently investigating this subject

of the origin of wheat, and after pointing out many features of interest in connection with it, asks—

“What, then, are the inferences that I intend to draw from this chain of evidence? First, a confirmation of the fact that wheat has been the common food of man at least ever since the Flood, and that it then possessed the same features and bulk of grain as at present; and, secondly, that the East, which was first inhabited by man, and was the subject of the catastrophe of the Deluge, *was the native country of that cereal*, from whence, when the race became scattered and emigrant, they conveyed it wherever they went; and thus it became circulated, first on the countries bordering the Mediterranean Sea, and from thence extended by the Romans in their conquests to the various countries subjected by them.

“Away, then, with the fruitless idea of finding a parent for this universal plant in any of the grasses bearing an affinity to it. Doubtless many of these are cereals, and by cultivation may be raised far above their station in vegetable life, as you may make a lord of a clown or a blacksmith. We know well what cultivation will effect in the most unpromising plants and animals; and, in the floral department, what wonderful transformations are daily produced by it. We know, too, that if cultivation is neglected, these plants will revert to their original condition; but such is not the case with wheat. Some of the finest types of that grain we receive by importation grow spontaneously in the interior of Russia; that is, the ground *is left to seed itself* from the former crop, and is only ploughed-in in the most rude and slovenly manner.

“Such is the theory I have adopted of the origin of wheat. I believe it to be one of those natural blessings which were originally bestowed upon man, to enable him, by the use of the powers and faculties he possesses, to avert in some measure the consequences of the curse.”

Wheat belongs to the order of plants monocotyledonous—that is, having one seed-lobe; and having endogenous stems—that is, stems which are increased from within, and are hollow and nearly parallel, or of equal diameter throughout, not increased by layers or rings (exogenous). The leaves are long and tapering, and have parallel veins not reticulated like the leaves of exogenous plants. This class of plants is termed *Glumales*, from the glumes which take the place of the calyx or outer envelope of ordinary flowers. The order in this class of plants to which wheat belongs is called *Graminaceæ*, and the genus *Triticum*; so called because the seed is to be ground or *trituated* (from *tritum*) before being fit for use as food. The species of the family of tritoid plants are exceedingly numerous, and various writers have adopted various classifications. M. Vilmorin classifies them under seven heads, and the arrangement is adopted in Professor Wilson's excellent work, ‘Our Farm Crops.’ The principal classes are *T. sativum* and *T. turgidum*. (1.) *Triticum sativum*, or *common wheat*, this being divided into two classes, the “bearded” and the “smooth”—the bearded having twenty-seven, and the smooth seven varieties; to one of these belong our common winter and spring wheat, these again being distinguished by one colour, as red and white. Of the white varieties, the following are named by Professor Wilson—Brodies, Chiddham, Dwarf Cluster, Essex, Fenton, Hopetoun, Hunter's,

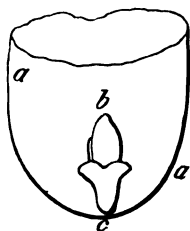
Pearl, Spring, Talavera, Uxbridge, Velvet-eared or Rough-chaffed. Of the red varieties—Barwell, Browick, Bristol, Glover's, Heckling's Prolific, Keningland, Lammas, Piper's Thicket, Spalding's, Velvet or Woolly-eared, Bearded. The second class of cultivated wheat is *Triticum turgidum*; this class is, however, not in general cultivation, being confined to districts where soil is cold and stony. The yield of this class of wheats is generally high in quantity, but in quality is low and coarse; but the straw not being, as in the other class of wheat, perfectly hollow, but partially filled up with a pith-like spongy substance, is strong, and capable of standing well under adverse circumstances, and is useful for thatching purposes. The varieties of turgid wheats named by Professor Wilson are Rivet common, Rivet bone, Egyptian or Mummy wheat.

The class of *Triticum sativum* has been in agricultural nomenclature, and is still by some, divided into two—summer or spring wheat, *Triticum sativum*; and winter wheat, *Triticum hibernum*. This distinction is, however, now discarded, as it is admitted that by change of circumstances their characteristics may be changed also, so that by repeatedly sowing winter wheat in the spring, we can alter its ripening capacities so as to make it spring wheat, and *vice versa*. "Spring and autumn wheat," says Professor Buckman, "are not specifically distinct; both the one and the other may be sown in any month of the year, a subject upon which I have experimented again and again, and thus given a spring wheat the habit of a winter one, and the reverse."

The habits of growth of the plants of the farm are not only interesting in themselves, but afford, when investigated, some valuable lessons, useful in farm practice. It will be doing those of our readers a service who have not considered the subject from this point of view, if we go somewhat into the details; and this we cannot better do than by giving a rapid *resumé* of an admirable paper by Professor Buckman in the seventeenth volume of the 'Royal Agricultural Society's Journal.'

If we examine a grain of sound wheat, we find that the *perisperm* or outer husk (*a a*, fig. 1) covers the

Fig. 1.



embryo, *b c*; this having at its upper part the *plumate* *b*, from which the axis ascends, which carries the leaves, and ultimately the seed; and at the lower part the *radicle* *c*, from which, on the seed germinating, the roots proceed. On the seed being placed in the ground under circumstances favourable to its proper germination, the radicle *a*, fig. 2, bursts through its integuments, and lateral *rootlets* begin to develop themselves to the right and

left. These rootlets are but sheaths, which, at the early stages

of the germination of the seed, cover the *true root b*, fig. 2. These roots are elongated for a greater or less distance without sending out lateral branches or fibres; but these at last appear proceeding from slight projections on the side of the roots. These fibres, again, give rise to other lateral branchings out, and are called *fibrils*. These developments take place in winter-sown wheat—which is that we are at present examining—according to the mildness and severity of the season. Little progress is made in cold weather, but in mild a few fresh rootlets will bud from near the base of the old ones, and coincident with which a bud starts from the axil of the first leaf. Where the plant is hardy, each of the early leaves may develop like a bud, and new roots will start and strike into the soil, from which to draw up the nutriment; so that in a short space the initiative of several heads of wheat will be

Fig. 2.

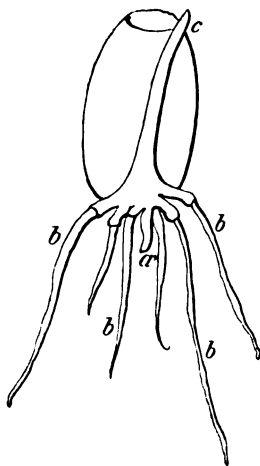
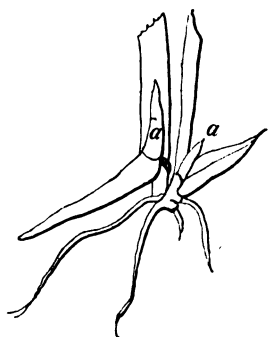


Fig. 3.



obtained from a single seed, as shown in fig. 3, in which *a a* are the heads starting from the axilla of the root-leaves, these last in the diagram being turned back, so as to show the leaf-buds. We thus see that in the process of *tillering*—as the technical phrase for this first development of the wheat plant puts it—the two organs, roots and leaves, are developed coincidentally with each other, a new bud requiring a new root to bring up its nutriment from the soil, whilst the older roots branch out into fibres and fibrils, and get further removed from the centre of growth.

The process of tillering does not go on under uniformly favourable circumstances. Much depends, for instance, upon the thickness with which the seed is sown, and upon the mildness of the season. Upon the question of thick and thin sowing we shall have something to say in its proper place; so we shall at present leave it, only now stating that, where thick sowing is practised, the plants come up thin and emaciated, and so close that there is no room for their laterally branching out. Mild weather in winter causes the condition in the wheat plant known as *winter proud*, in which the upward development has not been arrested;

so that its strength is given to the part above ground, weakening the tillering process, which enables the roots and fibres to be developed to their proper point. Where wheat is in this condition, the beneficial effects of eating it down by sheep, or even cutting it by the scythe, will be easily understood. We now come to examine the habit of growth of the wheat plants in the spring, which bring about a renewed action of the growth of the winter-sown wheat. Many of the older fibres die during the winter, but on the return of more genial weather new buds are produced, new roots being pushed into the soil, and new fibres and fibrils are produced from these. When the central axis of the plant has by these means been developed or elongated sufficiently, tillering of the plant ceases, and the whole of its strength is devoted to supply the upper part with its leaves and stems. These latter vary in number, according to the value of the plant, from five to twenty, and produce the ears of grain, which all ripen nearly at the same time. Such is the habit of growth of winter-sown wheat. Professor Buckman next proceeds to show the difference between it and that sown in spring. As we have before stated, winter and spring wheat are not specifically distinct; and that it is easy to give a winter wheat the characteristics of a spring one, and *vice versa*. Professor Buckman gives the following Table, showing the results of some experiments upon different varieties of wheat, bearing upon this point:—

TABLE OF THE GROWTH OF WHEAT IN EACH MONTH OF THE YEAR.

Years.	Months.	Height.		Length of Head.	Remarks.
		Ft.	In.	In.	
1851	June	3	5	3	Clean straw.
	July	2	10	2	Do. do.
	August	4	1	4	Do. do.
	September	3	11	4	Do. do.
	October	3	10	4	Rather blighted.
	November	3	9	4	Do. do.
	December	3	10	3½	Much blighted.
1852	January	3	10	3½	Do. do.
	February	3	6	4½	Do. do.
	March	...	...	...	{ Failed as a crop, but same year ripened.
	April	...	...	...
	May	...	...	...

"The winter," says Professor Buckman, "was mild and wet. All the samples were gathered in August. The September, October, and November plots gave the best samples; that sown in March, April, and May was by far the worst in the series. Blight both in straw and ear was most prevalent from December, though in spring months that sown in June, July, August, and Septem-

ber, was clean in the straw ; but the ears of the July sample, though they ripened, were remarkably small. From this experiment we see, that although the wheat sown in the autumn months certainly succeeded best, yet that of the spring months gave a yield : and indeed winter varieties of wheat are often not sown until as late as the latter end of February ; and we must remember, that if winter wheat be left until the spring for sowing, it behaves in its rooting and tillering much as spring wheat, and hence the difference is merely one of growth." This difference may be described briefly : in spring the winter-sown wheat sends out new roots and fresh fibrils, tillering and forming tufts, the shoots of which root precisely like the central blade : this, which may be called the second growth of the winter-sown wheat, takes place at the same period as spring-sown wheat is coming up. The growth of the spring-sown wheat being so much quicker, as the time for its development and ripening is so much shorter, than that of winter-sown wheat, does not, therefore, tiller to anything like the same extent. The development of the roots and fibrils goes on regularly, having no period of rest. The difference, then, between the growth of winter and spring-sown wheat is only one of degree ; nevertheless the difference is such, that it involves different treatment on the part of the farmer. In the first place, spring wheat must be sown more thickly than winter, as each seed brings forth a much smaller—as a rule—number of ears, and the thickness of the plants in the ground modifies the effects of the droughts which may probably supervene. So far as regards the preparation of the soil—on which point we have yet much to say in its appropriate place—that for spring must be very carefully prepared, so as to have a deeper tilth and more uniform depth than that for winter-sown.

Before discussing the subject of the habit of growth, in *its early stages*, of the wheat plant, it will be useful to give here a *resumé* of what Professor Buckman says on the subject of the lifting action of frost on wheat plants, commonly called *throwing out*. The changes to which soils, remarkably varied as they are in texture, &c., &c., are subject under atmospheric influences, are most commonly—1. Pulverisation and expansion after frost ; 2. Baking after rain ; 3. Compression when filled with moisture ; 4. Cracking in drought. Some soils are so loose that heavy winds shift them along with their sustained crops ; this is more especially, if not wholly, the case with soils resulting from the disintegration of the more silicious bed of the New Red Sandstone. The evil may be remedied by giving a more tenacious stability to them, by mixing them with marl. It is a curious disposition of circumstances, that in districts where this soil is met with, stiff Kuper marls of the same formation are also met with. In Worcestershire, as pointed out by Professor Buckman, the marl forms rounded knolls,

from which it can be carted easily downhill to the light lands. The expansion of soils takes place very generally in "clunchy" clays, all marls having much lime and argillaceous matter in their composition, with a comparatively small proportion of sand. In soils of this nature the frost penetrates, and by expansion lifts the masses upwards in a remarkable degree. The soils in the Chalk and the Oolites are sometimes very liable to this expanding and lifting action—so much, that the wheat plants growing on them are frequently lifted out and left unplanted after the soil is rendered more solid by succeeding rains. Heavy rains get rid of this to some extent, by working the soil round and down upon the roots of the plants, and even to such an extent as to produce a skin or pellicle on the upper surface. Rolling and sheep-treading are also beneficial in such cases. But where this artificial consolidation is given to upraised soil, it is essential that, on the plants having again fairly taken to the land, hoeing and top-dressing should be done, to loosen the soil, and to expose it with its chemical fertilisers to the atmospheric influences, when the accelerated growth takes place. Professor Buckman points out that the best way to obviate the evils of this expansion of soils, in heavy lands, is to raise as large green crops as possible, and to plough in all the leaves. By this means a more equitable pulverisation of the soil is obtained, and by the gradual admixture of vegetable matter a loamy soil is ultimately produced. Farmyard dung, when in a fresh state—not decomposed and rotten—sometimes acts in increasing the expansive lifting action of soils, as the long straws act as media for conveying water into the soil, and which, becoming frozen and expanding, lifts the soil.

In the stiff and argillaceous soils of the Lias and Oxford Clays, the rain acts not by crumbling and lifting, but by enlarging the plastic mass of soil, so that it is compressed very tightly round the roots of the wheat plants, depriving them of their free power of growth and action. This *plastic element* in soil, as pointed out by Professor Buckman, is most injurious to wheat, from the comparative slowness with which decomposition proceeds, air and light being kept out. Coldness is also a marked characteristic of such soils, from their retentiveness of water. The remedy in such cases is thorough-drainage, mixing the soil with burnt clay, dressing with town-refuse, coal-ashes, &c., the use of fresh long farmyard manure, and of all other means by which the texture will be lightened, and the soil made friable and pulverised. Stiff soils are peculiarly liable to crack in dry weather, which is very injurious to the delicately-formed roots and fibres of wheat. If, after a long continuance of dry March winds, the soil gets cracked, the fibres are rent and the secondary growth is impeded, so that when the return of more propitious weather fills up the cracks, and restores the soil to its proper condition for the

maintenance of growth, that growth is given for some time in repairing its condition, in place of aiding the general growth.

Having thus described briefly the general habits of growth of the wheat plant, it will be obvious that the final and perfect development of the seed or fruit will be dependent upon the way in which their habits are aided. In the points involved in the discussion of the question as to how the productive capabilities of wheat are dependent upon the mode in which its habits of growth are consulted and assisted by the modes of culture, Mr Hallett, in a recent paper in the 'Journal of the Royal Agricultural Society,' has some interesting and suggestive matter. Mr Hallett, by the term tillering, understands the "horizontal development" of the roots; by the "vertical development," the growth upwards of the leaves and stems; and by the "natural" growth of wheat, that mode of cultivation which gives free play to its nature, or by which the habits of the plant—as those we have already described—are best aided.

The extent to which the "horizontal" development takes place in the growth of the wheat plant may be seen from the fact, "that the stems of a single grain, having perfect freedom of growth, will in the spring, while lying flat upon the surface, extend over a circle of 3 feet in diameter, producing at harvest from fifty to sixty ears." The vertical development is also dependent upon the way in which the horizontal development is aided or retarded. This, as Mr Hallett points out, is abundantly shown by the fact that thin crops generally produce fine ears.

In the choice of seed for sowing, there are some points of importance to be attended to. Where the soil is poor, the seed should be chosen from that grown on a rich soil; and from a cold climate, where it is to be grown in a warm one. But the farmer, by taking careful advantage of the system of "selection," may produce for himself a superior quality of seed. What is meant by this term, and what power it brings with it in enabling the farmer to increase to a large extent the produce of his wheat, has been ably explained and practically illustrated by Mr Hallett, to whose paper we have already referred, and to which again we return. Mr Hallett sets out by assuming that the "wheat plant, from its nature, requires a mode of culture which permits its perfect growth; and where it is so cultivated, by the repeated selection of the seed, of which, as in breeding animals, the result is a pedigree, we can gradually increase the contents of the ears without in the slightest degree diminishing their number." And he maintains that a good pedigree is as valuable in plants as in animals, and that in the careful rearing of the seed which has this qualification, "*lies our only means of materially* increasing the produce of the cereals." This notion as to the pedigree of plants carries with it so many important considerations, that it will be

useful to glance at the main features of Mr Hallett's arguments, all the more that they are impugned by many authorities, and not less openly sneered at by others—a mode of treating a scientific subject in every way to be reprehended, as beneath the dignity of any science. Moreover, the experiments—if trials on so large a scale as Mr Hallett has carried out should be so called—of Mr Hallett have been so carefully and conscientiously carried out, that his system is entitled to a patient investigation, not with a view to carp and quibble at the difficulties with which his theory may be surrounded, but to endeavour to find out, if possible, how these may be overcome, and what real practical value may be obtained from it. In connection with the *stock* of the farm, the importance of “pedigree” is everywhere recognised. Mr Hallett points out that it is even recognised in the case of *plants*, inasmuch as, if the farmer wants a good mangold, turnip, or the like, he selects the seed from a good *parent*. But this principle is ignored as a general rule in regard to the cereals, although why it should be so it is difficult to say, inasmuch as the minutest characteristics of a plant of wheat will be reproduced in its descendants;—so much so, that we can not only perpetuate the advantages presented to us in an individual ear, but, by the accumulation of selection, make further advances in any desired direction; the union of good qualities imparting a cumulative force, and their successive renewals and establishments conferring, as in animals, a “fixity of type.” But Mr Hallett points out what, on consideration, will prove to be a most important point, but which, nevertheless, has been too often ignored—namely, that the principle of starting with “*accidentally* fine ears, and simply keeping the produce unmixed, without any further selection,” is a wrong one. This is a very different thing from starting annually with one of a known and a good lineage. Mr Hallett is of opinion that the formation of what he calls a “race of high-bred” cereals, admits of a more rapid and higher development than that of stock, inasmuch as they are more prolific, and give a much wider choice in each renewed selection. Further, that in place of the delicacy of constitution observable in high-bred animals, a character the very opposite of this is obtained in the selected high-bred cereals, as these are descended from a line of ancestors, “each of which was the most vigorous of its year,” and possessed, moreover, the combination of those good qualities by which they were enabled, during the period of selection, to withstand the vicissitudes of the season. Mr Hallett gives a striking illustration of these truths, as he maintains them to be, in the following. In these experiments “the kind of seed, the land, and the system of culture employed, were precisely the same for every plant for four consecutive years, neither was there any manure used nor any artificial means of fostering the plants resorted to.”

TABLE SHOWING THE IMPORTANCE OF EACH ADDITIONAL GENERATION OF SELECTION.

Year.		Length in Inches.	Containing Grains.	Number of Ears on finest Stool.
1857	Original ear,	4 $\frac{3}{8}$	47	"
1858	Finest ear,	6 $\frac{1}{4}$	79	10
1859	Do.	7 $\frac{3}{4}$	91	22
1860	Ears imperfect from wet season, .	"	"	39
1861	Finest ear,	8 $\frac{3}{4}$	123	52

Thus by repeated selection *alone* the length of the ears has been doubled, their contents nearly trebled, and the "tillering" power of the seed increased fivefold. Mr Hallett also points out that he at first started by selecting from *accidentally* large ears, in the supposition that these would give a much finer produce the next year; but he found that the quality of the grain was so bad as to be unsaleable, and this result was the invariable one of all trials in this direction. He therefore adopted a plan which we think was the most philosophical of the two—namely, selecting an ear which gave the *finest quality* of grain, and trusted to the power of the selecting principle to increase the size and development of the ears. Mr Hallett chose, in the first instance, the "nursery" wheat, the finest red wheat known. The following is the plan of selection adopted:—The produce of a single grain is a bunch, or, as Mr Hallett calls it, a "stool," consisting of many ears. The grains are carefully taken from *each ear*, and are planted in such a manner that each ear, or rather the grains which were taken from it, occupies a row separate and distinct from any other row, and the distance between each grain in the row is 12 inches. The grains from another ear are sown in another row, 12 inches from the first row, so that all the grain is deposited in 12-inch squares. When the ears produced from the different grains are ready, a very careful study and comparison of the stools from all these grains is made, and the finest *one* is selected, and accepted on the principle that the parent grain which produced that "stool" was the finest of the lot. The grains produced from *each ear* of this stool are again planted or sown in separate rows, as above described, for the selection of the second year, and so on each year. The result of the repeated investigations of these repeated trials has shown Mr Hallett the essential importance of *repeated selection*, inasmuch as in the grains produced from the same ear *one is found greatly to excel all the others in vital power*. Mr Hallett, referring thus to these and to other circumstances, which space does not permit us to allude to here, as evidence that "selection" is capable of increasing the *contents* of the ear, proceeds to show that it is also powerful in increasing the *number* of the ears. There are no correct,

or even approximatively correct, data at our command showing the number of ears produced from the usual quantity of seed sown per acre, which may be set down at 7 to 8 pecks. Mr Stephens estimates it at about the same number as there are grains in a bushel, or under 800,000, which is equal to about one ear of produce for every two grains of seed sown. Taking these data as they are, Mr Hallett computed the numbers given in the year 1861 upon the two systems, one his own selection, and the other an ordinary method. The two fields upon which these were tried were simply divided by a hedge. In the one instance—the old method—the number of pecks to the acre of seed sown was 6, and from this the crop was 54 bushels, consisting of, at its thickest part, of 934,100 ears. On the “selection” system, the quantity of seed sown per acre was *four and a half pints*, the seed being sown or dibbled 12 inches apart each way, and the number of ears produced was 1,000,880, or 67,760 ears in excess of the other yield; thus giving this excess with a saving of *twenty-one times the quantity of seed*. The system of “selection,” in being carried out into practice, will obviously modify that as at present adopted. The first modification is the *time* of planting; that this must be earlier than the present is obvious enough, inasmuch as a grain which has to occupy a large space of ground, and is expected to produce a greater number of ears, will require a longer time than if grown under ordinary circumstances. The second modification is, the necessity for apportioning the quantity of seed in proportion to the time at which it is committed to the ground. This, however, is done in ordinary practice, where the quantity of seed sown is greater in proportion as the time of sowing is later. The third modification is, the distance at which the seeds should be sown: this may also be subjected to change, according to the time at which the sowing is done. Mr Hallett, in giving directions upon these three points, says that he can only do so on the supposition that he has *selected* seed to deal with; for the different grains of ordinary wheat are so very unequal in reproductive power, that it “would be manifestly impossible to fix on any uniform distance” or quantity. For as regards distance, it is clear that if a certain space was that which was required for a vigorous grain, for a less vigorous one it would be too much. While on this point, Mr Hallett draws attention to the fact that by selection the reproductive power of wheat is *equalised* in a very remarkable degree; and that the equalisation is just in proportion to the length of time over which the selection has been carried; and this equalisation is not confined to one, but it is observable in all the peculiarities of the plant.

The following is the mode recommended when this system is proposed to be carried out on a small scale of a few acres, the grains being dibbled *singly* in holes not exceeding $1\frac{1}{2}$ inches deep:—

	Distance be- tween the Rows.	Distance in the Rows.	Quantity of Seed.
In August or <i>early</i> in September, .	9 inches.	9 inches.	1 bushel on 6 acres.
In September,	9 " "	6 " "	1 " 4 " "
In October,	6 " "	6 " "	1 " 2 $\frac{3}{4}$ " "
Towards end of month,	6 " "	4 " "	1 " 2 " "
After October,	6 " "	3 " "	1 $\frac{1}{2}$ " 2 " "

In applying the system on the large scale, the dibbling system is so expensive that Mr Hallett very ingeniously adapts the ordinary "drill" to the depositing of rows of single grains. To this we shall refer at another part of our paper, meanwhile noting a brief summary of the advantages claimed by Mr Hallett for his system. First, *in the extension of the seed-time*. This is obtained by commencing in September, giving this and the two following months in which to sow, and of which the two first usually give finer weather than November. Second, *the small quantity of seed required*. This is evidently an important point; for although Mr Hallett does not make this a feature of his system, but only as a means by which he secures a perfect growth of the plants, still it is a point which naturally flows out of his system, and to the benefit of which, therefore, he is fully entitled. If, as he says, the wheat-lands of the kingdom were drilled with an average of even two pecks per acre (one peck for the early, with one peck for the late), a saving of three-fourths of the seed usually employed would be effected, or nearly a *million quarters of wheat*. But by the adoption of small quantities of seed, advantages peculiarly applicable to the development of the system of selection are obtained. Thus, in 1861, Mr Hallett had a field of seven acres planted with the produce of a single grain planted two years before; one acre of the seven with produce of a single ear planted in 1860. Seed "one generation still further selected" can thus be annually imported from the selecting plot to the farm; thus effectually counteracting the tendency to degenerate, which all plants have. But the further the selection is carried out, the less is this tendency to degeneracy developed. Mr Hallett draws special attention to the importance of *continuing* the selection; indeed, he says it cannot be too much insisted upon. For to "discontinue it would be as unwise and irrational as the conduct of the breeder who, having brought his herd to a certain pitch of excellence, suddenly exhibited an utter disregard of those principles by which this had been accomplished: in fact, the man who once admits the value of repeated selection, must also admit the necessity of its continuance, even for the mere maintenance of *perfection*, were this desirable point already attained. In nothing is it more true than in this, that 'not to advance is to retrograde.'

The value of pedigree in wheat depends, as in other cases, upon its length."

The third point of excellence claimed for the system of selection is the *rapid growth of the plant in its earlier and more hazardous stages*. The rapid growth in the comparatively genial weather of September, causes such a development of the plants that they are placed generally beyond the attacks of their enemies. And this development is not obtained at the expense of its being "winter proud," for the development of pedigree, or selected seed, is towards tillering, not to the *upward* growth of the plant. The fourth advantage claimed for the system is *the time afforded for replanting in case of entire failure*. If wheat, selected, is sown early in September, it is usually destroyed or is perfectly safe in six weeks, for by that time the plants will either have been overcome by, or have overcome, their enemies. If destruction is the lot of the crop, ample time still remains for sowing in the latter half of October and the month of November. We have thus given a fair *resumé* of this "selection" system; what has been said of it by various authorities, and how far it is likely to be beneficial in farm practice, we shall see in our next Number.

B.

HAMBURG, WORCESTER, AND KELSO.

ON the evening of the 8th July the screw steam-ship Gertrude—which, like many a member of the human family, proved a good deal better than she was "bonny"—left the port of Leith with a full deck-cargo of pure-bred stock, consigned by Scotch breeders to the Messrs Swan of Edinburgh, for exhibition at the great International Show at Hamburg. The passengers were few, consisting chiefly of those who were one way or another interested in the Hamburg exhibition, with three ladies, a German sea-captain, who had been long cruising in the East, a Danish merchant, and a half-caste youth from Cuba, who could speak or understand nothing but Spanish—a language of which none else on board knew more than a word or two. It was just such a company as was likely to enjoy itself, especially when every effort to that end was heartily seconded by the skipper of the steamer, than whom a better or a jollier in every way never walked the quarterdeck, or took the bearings of the red sun at noon. Not much progress in the way of acquaintanceship could, of course, be made the first evening, as the shades of night had fallen over sea and land ere we had passed the Bass Rock on our way out of the Firth of Forth; and the stars overhead had less attraction for

the majority of the passengers than the small but comfortable berths below.

Next morning the writer, along with two other of his fellow-travellers, were early astir ; and sitting on the seat of the companion window, one carelessly hummed an air, and quietly beat time with his feet upon the deck. Suddenly there was an apparition of a bald head, then a face of usually pleasant expression, but just now rather unamiable from mingled annoyance and anger ; head and face emerging from a long loose dressing-gown, which completely shrouded the stout, rather short body of the Danish merchant. "Dat is not fair, dat is not fair !" he said, as soon as he had got half-way up the ladder leading from the cabin to the deck ; and he continued, after he had fully ascended, " You be drum, drumming above my head. I cannot sleep. You did drum more than twice ; I shall not go to bed again." Two drummings might have been borne, but three were beyond human endurance. The poor drummer, who was utterly unconscious of his own musical performance, was thoroughly taken aback by the rebuke, and made the best apology he could, which seemed to have been accepted by the Dane, as, after looking at the compass and muttering " South-east, quarter east," he disappeared down-stairs to his sofa. Though this was not one of the most agreeable of introductions, the little unpleasantness in connection with it was almost instantly forgotten, and the Dane proved himself decidedly one of the most agreeable and best-informed of our voyagers.

The weather, fortunately, was fine, and after breakfast the ladies joined the party on deck, and contributed not a little by their pleasant conversation to beguile the tedium of the journey across the North Sea. The Spaniard, who could not speak or understand the English language, entertained himself and others by cutting paper into all sorts of ingenious shapes, and the German captain gave interesting incidents from his experience in Chinese waters.

It is curious how soon people become reconciled to the necessities of their position, and with what real zest they can enter into amusements which they would unaffectedly despise at other times and in other places. For instance, pitching pennies at a mark, or into a bowl on deck, and games such as only children could tolerate on shore, were a source of laughter and enjoyment for men at sea. Perhaps the remarkable simplicity of character which, generally speaking, belongs to all sailors, may be in some part due to the fact that at sea the readiest, if indeed not the only, sources of amusement are those which are common to children and school-boys.

The second day, which was also as fine as the first (finer indeed, for a brief fog during the first day caused us to slacken speed and sound the steam-whistle at short intervals to prevent accidents), passed much in the same way ; and on that night we had anchored

at Cuxhaven, waiting for the tide to float us over the bar in the Elbe near Hamburg.

Anchor was weighed early next morning, and as we steamed slowly up the Elbe we had ample opportunity of noting the agricultural features along its flat banks. The land in the immediate vicinity of both sides of the river is chiefly devoted to grazing, and on the pastures were herds of cattle almost as numerous as flocks of sheep. The disadvantages of overstocking have as yet, it is evident, never become apparent to the Holstein and Hanoverian farmer. The land, undoubtedly, is eminently adapted for the growth of grass; but no soil, however rich, could long remain profitable under such an enormous amount of stock as was feeding upon the plains at the time of which we write. The cattle generally bore a strong resemblance to our Ayrshires, but they were much larger and coarser. The cows had every appearance of being good milkers, and are no doubt a very profitable breed for the country. At the same time, they could manifestly be greatly improved by care and selection in breeding. We did not notice very many sheep, and those we saw were of the unsightly merino type. To our eyes, it is only when fat and full of wool that these sheep are at all passable; lean and clipped, they are an eyesore in the landscape. But the owners of crack breeds think them perfect models of beauty, and adorn their walls with endless photographs of the wrinkled beasts. Looked at in a pecuniary point of view, however—and that is the way that agriculturists must of necessity regard them—they are perhaps the best for the country. Mingling with the pasture here and there were fields of rye, buckwheat, and wheat, almost all of it wearing the golden hue that becometh the sickle, before which already portions had fallen. The appearance was excellent. The hay had been mostly secured, and from the little that was still outstanding we judged that the crop had been abundant.

The farmhouses along the river are mostly old and very quaint—straw-thatched chiefly, with many pointed gables, brilliant with paint, green, brown, and white, and all with an air of cleanliness about them which might be imitated with advantage at the farmsteadings of Great Britain. The farms, until within a dozen miles or so of Hamburg, for the most part, and on the Holstein bank especially, belong to the cultivators. This may in part account for the comfort and neatness which appertain to them. Such power as is needed on the farm, beyond that which manual and horse labour supply, appears to be furnished by windmills, which swing their giant arms monotonously in the neighbourhood of almost every steading, as well as in places where no farmhouse is to be seen. The landscape is also dotted all over with poplars, arranged in groups like so many exaggerated Druidic pillars.

On the bosom of the Elbe itself, floating lazily up with the tide,

are hundreds of curiously-shaped boats, something after the fashion of Chinese junks, with flat keelless bottoms, broad red sails, and gaudily-painted sides, for the conveyance of peat from the mosses near the mouth of the river, to Hamburg and other parts of Germany farther inland. Singular boats, with masts formed out of one tall pine, the deck roofed over with rough planking, something in the way that masons' sheds upon the streets are covered, the boards being tarred as a further preventive against the rain, are also very common on the Elbe. These are used in the transport of goods inland, and in great part for the conveyance of wheat from the Black Sea by way of the Danube.

As we approach to within a few miles of Hamburg, we find the land on the Holstein side of the river entirely occupied with the mansions and gardens of the rich merchants of the city. Many of the houses are princely residences, and the grounds surrounding them are laid out and planted with great taste. Roofs of straw on such houses are not uncommon, and amid such grandeur they appear incongruous to the eye of the Britisher.

By Saturday at noon the Gertrude lay safely moored alongside the cattle quay at Hamburg, her cargo of show-beasts in no way damaged in appearance or constitution by their three days' voyage.

The dangers of the ocean, however, which (knowing the value and the liability of damage to such stock) had weighed heavily on the captain's spirits all the way across, were as nothing compared to the danger likely to ensue from trusting them in the hands of Germans from the wharf to the show-ground. Unfortunately, the number of Scotch hands over with the stock—which consisted of shorthorn bulls, Ayrshire cows, polled Angus and Galloway, and a West Highlander, with sheep and horses—was not sufficient, and the management of some of the animals had to be intrusted to German drivers. A more helpless lot among breeding, or indeed any cattle, it would be impossible to imagine. They had no idea how to manage. Their whole method of driving consisted in making as great a row as the state of their lungs would permit. The consequence was, that they frightened the animals, and those not fastened with ropes rushed off hither and thither. The West Highlander was particularly restive under German treatment, and, though roped, it bolted off with its driver at break-neck speed, rushed into the hedges, stuck its horns into the road, made feints of attacking various fat and respectable-like persons on the street, to their mortal terror and the Scotchmen's infinite amusement, the poor driver all the time pale, perspiring with fear, and hoarse with bawling, yet holding on by the guiding-string as if for very life. Another German took his place, with no better result; but under the direction of one of the Scotchmen, the beast walked to the show-ground without halter as quietly as a lamb.

The exhibition which was the occasion of bringing this stock

away so far from home was the first of the kind that had ever been held in Germany. It owed its origin mainly to Baron von Merck, the Prussian Ambassador, who unfortunately did not live to see the show, and some fifty of the merchants, &c., in Hamburg. Nothing that was likely to insure the success of the exhibition was omitted to be done. They offered to begin with a very liberal prize-list, amounting in all to 22,440 thalers, or £3366 sterling. Of this £885 was distributed for horses, upwards of £200 being given for breeds from Great Britain alone; £1731 was offered for cattle, £290 for British-bred shorthorns, Ayrshires, and other breeds from this country; and £97, 10s., out of the £397, 10s. given for sheep, was set apart for those from Britain. For pigs and poultry £200 was given, no restrictions being placed on the competition; and there were, besides, several classes in horses and cattle where animals from Britain were allowed to compete.

That success might be still farther assured, the committee took care to select a convenient and very commodious site for the show-ground, the Heiligen Geistfelde, an extensive park of some 40 or 50 acres, lying between the curious old Danish town of Altona and Hamburg. Avenues of trees surrounded this park, emerging from which might be seen the spires and golden-crowned cupolas of many of the tall churches of which the chief city of the Hanseatic League can boast, and in particular the lofty Italian dome of St Michael's, which is said to be a great deal higher than the golden cross on St Paul's, London, though it certainly does not look so, perhaps from the fact that it is dwarfed by a rising background. The show-yard, which was enclosed with hoarding after the fashion of our English and Scottish national shows, was a kind of parallelogram, with a projecting semicircle at one side, and with a square projection less marked on the side opposite. The sheds for stock, exclusive of horses, which had quite palatial accommodation in the semicircle, numbered altogether about seventy, all substantially fitted up, and arranged with judiciousness and tact. There were, besides, a large number of sheds devoted to agricultural implements, and a large space of uncovered ground set aside for the display of agricultural machinery in motion. In the centre of the ground a magnificent refreshment-room was erected, decorated in that good taste which the Continental nations possess in so eminent a degree, with flags and evergreens; and in connection with this saloon there was a fine balcony, from which, at the conclusion of the show, the committee distributed the prizes to successful competitors. Close by where this temple to the physical wants of man was reared, rose another edifice, tier upon tier, like a Chinese pagoda, which was also profusely ornamented with bunting and flowers, and crowned with a gigantic statue of the Genius of Agriculture. This was dedicated to the Goddess of Music, and soothed and satisfied the mental cravings after the appetite was appeased. Immediately in front of this, and reached by

sloping grass terraces of the most exquisite green, interspersed with the choicest flowers, was an artificial lake, with an artistic fountain in its midst continually playing ; while around the sides, under cover, were arranged a splendid collection of floral specimens of all colours and varieties, and from almost every clime. Outside these flower-sheds there were orange-trees in all stages of fruit and flower mingling with coniferous plants of great beauty and variety. The grand entrance-gate was at this point. It was not like the paltry triumphal arches we are accustomed to see in this country, but a thing exhibiting great architectural skill, and of real beauty, composed of the flags of all nations, evergreens, and flowers. At the end and centre of every shed, and elsewhere up and down the grounds, flagstuffs were erected, from the top of every one of which floated flags of all nationalities, descriptions, and colours. The *tout ensemble* was really superb, such as can be but faintly imagined by the *habitués* of agricultural gatherings at home. The cost to the committee of getting up the show amounted, we are told, to about £26,000, and we can well believe it.

The number of stock exhibited was unprecedented in agricultural history, numbering, exclusive of 328 entries of poultry, no less than 3548 animals—almost twice as many as were assembled in the Great Park at Battersea in 1862, when two great national shows united their strength ; whereas at Hamburg the committee had little or no basis to start from but their own energy and perseverance, which cannot be too much praised. Altogether, thirty-four countries sent stock or machinery for exhibition, of which the principal were—Great Britain, which sent 67 horses and ponies, 132 cattle, 400 sheep, 89 swine, and 77 implements and machines ; Hamburg, which contributed 86 horses, 85 cattle, 116 sheep, 57 swine, 131 poultry, and 87 implements and machines ; Hanover, which forwarded 217 horses, 233 cattle, 145 sheep, 35 swine, 147 poultry, and 67 implements, &c. ; Mecklenburg-Schwerin, which sent 32 horses, 13 cattle, 66 sheep, 24 swine, 8 fowls, and 22 implements, specimens of agricultural produce, &c. ; Austria and the Crownlands exhibited 4 horses, 83 cattle, 156 sheep, 6 swine, 3 fowls, and 100 machines, &c. ; Oldenburg sent 12 horses, 58 cattle, 1 sheep, and 4 implements, &c. ; Prussia contributed 36 horses, 74 cattle, 526 sheep, 59 swine, 19 poultry, and 102 implements and specimens of agricultural produce ; Holland sent 50 cattle, 26 sheep, and 14 implements, &c. ; Russia sent only 4 horses and some agricultural produce.

Up to this point, the comparison of the Hamburg Show with shows at home has been all in favour of the foreigner. Beyond this, the comparison is all in our favour, if we except the class of coaching horses, which are more symmetrical, and have, we think, fully better action, than our own. As a rule, our coach-horses are a shabby lot ; and, of late years, we seem to have more weeds on our

streets than formerly. The coach-builder's art has been improving, but the same attention has evidently not been paid to insure that the horses shall keep progress with the style of carriage. Many very fine carriages we notice are spoiled by the cattle that drag them. The coach-horses at Hamburg were, as a class, first-rate, and a very even lot. They were all in beautiful condition, and of a most appropriate size for their work. Riding-horses also suffered little disparagement when contrasted with our own; hunters were good, but racers wanted muscle; and the cart-horses lacked substance and bone. There were some charming Arabians present—a kind of horse which, for elegance of form and gracefulness of action, undoubtedly stands unrivalled in the equine race; but the Eastern belief in its speed and power of endurance has been rudely shaken by a recent match in Egypt between one of the crack specimens of the breed and an old English race-horse, the latter coming in an easy winner. The great variety of colour in the horses was something for wonder to an Englishman.

It was in the cattle classes, however, that the superiority of English and Scotch stock was most distinctly marked. The British breeds spoke of long years of improvement—improvement achieved only by close study of physiological laws, involving great care in the selection of animals, great skill in the crossing of different strains of pure blood, and of vast expense incurred in carrying out those objects. The foreign breeds afforded no proof of any great effort or expense having been made for their improvement. No attempt, or at least no effectual attempt, had been made, so far as we could judge, to fine down the bone, increase the symmetry, hasten the powers of maturity, and superinduce the aptitude to take on flesh on those parts where meat is most desiderated. In fact, some of the cattle appeared to be exactly of the type that were preserved in the ark with Noah, if the pictures of the ingathering of the beasts into that ancient ship can be relied upon as portraits. But excellence in breeding can never be obtained until the characteristics of a breed have been accurately ascertained and distinctly defined. This the Germans have as yet failed to do. For instance, the very first cattle-class in the catalogue is set down as "*Sämmtliche Marsch-Schläge*"—that is, Marsh cattle, and suchlike. Fancy our catalogues having a class of shorthorns and suchlike! Until there is a more definite classification than this, there can be little done to improve the breed of cattle. The animals in this class were of the kind we have described as feeding upon the pastures in the vicinity of the Elbe, and are decidedly the most useful in the country. But, they are coarse in the bone and thick in the hide, as compared with our own Ayrshires.

It would be of little interest to a British reader, and could serve to little useful purpose, to enter into details about cattle whom their owners cannot describe. All that we need remark is, that the cattle

were much more picturesque than promising subjects of agriculture. Some of them were of immense size. One ox—and he was not in very good condition—measured 5 feet 10 inches in height; but he was eight years old. Unless he had been used at the plough, he could hardly have proved profitable to his owner. The animals sent from Holland were large, merly (white and black) coloured, and taking something after the Galloways in shape. There were several teams of work-oxen—strong-boned, wide-horned, long-bodied, and long-legged animals, which, after their work-days are over, are fattened up and killed. Tough eating they do prove.

The sheep sent from Continental countries were mostly merinos; and here, more than in any other section, there was evidence of care and selection in breeding. It is strange that the good results following this attention to sheep should not induce a similar policy with cattle.

The foreign pigs were a wretched lot, repulsively coarse, hard-skinned, porcupined-bristled brutes, and some of them apparently not above one generation removed from the wild boar of the forest.

The Show opened on Tuesday, the committee of management having been very busy from the previous Friday, Sunday especially, in placing the stock. The charge on the first day was 4 thalers, or about 12s. in English money—visitors, however, being able to compound for the whole week for a payment of 6s. more. Notwithstanding the high charges, visitors literally flocked in in thousands; and on the other days, when the charge was reduced to 2 thalers and 1 thaler, the crowds were immense. The committee, we understand, were fully compensated for their lavish expenditure. The great proportion of the visitors were Germans and Dutch. The French were not largely represented, and there appeared to be very few Russians present. There was, however, a sprinkling from almost all civilised nations; and the variety of dress, complexions, features, and manner, collected within the limited area of the show-ground, was something for marvel as well as study.

The machinery department was not very interesting, inasmuch as the foreign exhibitors showed nothing whatever that was not copied from English manufactures. At Battersea the foreigners made many purchases, and these they had taken to pieces on their return home, and slavishly imitated in every respect; and, like imitators in poetry, the imitation was in no case equal to the original, the various parts being not nearly so well fitted, and the workmanship much more clumsy. A locomotive-engine, with Boydel's patent wooden way, which one hears very little of in this country now, and which never was regarded with any particular favour here, was a source of great attraction to the Germans. As soon as it started on its rounds in the show-ground, the people deserted the stalls of horses and cattle, and crowded round the cumbrous machine, staring at it with open-eyed and open-mouthed astonishment. There

was a trial of locomotives on the streets one day, and as the engines departed out of the show-ground, they were accompanied by hosts who had just paid their 2 thalers to go into the yard. After a short time spent in racing up and down the street, the engines returned; but, greatly to their disgust, the visitors who had followed them out, found that they could not enter along with them unless they paid over again. The executive committee of the International, like all other people in Hamburg, knew well the wisdom of making hay while the sun shines.

The trials of steam-ploughs and reaping-machines were, no doubt, very interesting to the Germans, but they were not satisfactory to the Englishmen, inasmuch as the places where the competitions were conducted were not at all adapted for the purpose. They were small plots of soft nasty land, interspersed with deep drains—such places, indeed, as no sensible man would work such machines in. The mere fact of such fields being chosen, was a striking proof of how far the German agriculturists are behind our own. Among other noticeable things in connection with the Hamburg Show, it was a matter of surprise to the Englishmen to see the judges march round the stock with the catalogues in their hand; and that Germans have little faith in the honesty of their countrymen who are breeders, was made manifest from the fact, that a German nobleman, who had purchased a shorthorn bull from the Scotch agent, could not be satisfied that he had got the one entered in the catalogue, though its pedigree was furnished him from the Herd-Book, until he had received, in addition, a line from the English nobleman to whom it belonged.

The Hamburg Show will, doubtless, give a great impetus to agriculture in Germany, as it enabled breeders to compare their stock with a few of the best of the cattle in this country, most of which were purchased to remain in the Continent; and it is likely to create a constant demand that will prove remunerative to our own breeders. Already we have seen orders for young shorthorns from one of the noblemen, who was a large buyer at Hamburg. Foreign breeders, however, should remember that it is not enough to procure good stock; they must keep it pure after they have got it. The necessity for this must have been made quite evident to them by the poor appearance which the shorthorns bred on the Continent presented alongside our own.

Hamburg, which entered into this great agricultural enterprise with so much spirit, and conducted it to such successful issues—issues which entitle it to the gratitude of all the other German states—has itself but a very small territory, and therefore, one would think, but a small interest in farming pursuits. Including half of the Bergedorf district, its whole extent is about seven German square miles, about one-ninth of which is occupied with the town and its suburbs. About one-half of the land is classed, for administrative

purposes, as marsh-land, and the other seven-eighteenths as *geest-land*. The marsh-land consists principally of the islands in the river Elbe and its branches, and the lands on each side of their course. The soil is a strong clay, intermixed with the deposits from the overflow of the river ; and about one-third of it is grass, and two-thirds under the plough. It is very fertile, and produces good crops of wheat, barley, oats, and beans, which, under a more efficient style of cultivation, could be raised in greater quantities. The grass-lands afford food for the dairy cows which supply the milk for the town. These lands are often flooded in winter and spring, and water-mills and sluices are employed to drain off the water. In the Bergedorf district are the four divisions of the *Vierlande*, which is the most fertile part of the territory, and the inhabitants, numbering some 10,000, are generally regarded as more industrious and skilful farmers than their brethren elsewhere. A good deal of the land here is laid out as market-gardens, in which excellent vegetables and fruit are grown. Irrigation is much practised here, and with good results.

The geest-land, originally a part of the duchy of Holstein, forms the remainder of the Hamburg territory, and has been acquired by the citizens in the course of centuries by treaty or purchase. It consists of the higher country north of the town and four districts in Holstein. The soil, as the name implies, is of a light sandy description. About one-fourth of this district is in meadow or grazing land ; the other three-fourths are under the plough. This latter part, unless well manured, produces but scanty crops of rye and buckwheat ; these and potatoes are taken, and, after being fallowed, a like produce is again obtained. Scarcely any cattle or sheep are fattened on the Hamburg territory. The separate district of Ritze-buttel, near the entrance of the Elbe, including the port of Cuxhaven and the island of Neuwerell, also belongs to Hamburg. It is twenty English square miles in extent, and has a population of 6000. About the half of this district consists of meadow and arable marsh or geest-lands, the other half is mostly heath and waste land, suited only for sheep-runs, on which several hundreds of these animals find nutriment during a part of the year. On the island of Neuwerck there are but thirty-seven inhabitants ; the meadow-land amounts to about 580, and the arable to 340 English acres. For this account of the Hamburg territory we are indebted to the last report of Mr Ward, late British Consul-General at Hamburg.

During the time of the show, the crops were either being reaped or approaching readiness for reaping, and looked well both as regards quantity and quality.

Coming across the Continent, we had opportunity of seeing the crops in portions of Hanover, Prussia, France, and Belgium, and, as a general rule, they appeared excellent. In Belgium the wheat crop was magnificent, showing how much can be accomplished by industry and skill even on very unpromising soils.

From Hamburg we came direct to the old loyal city of Worcester, where this year the Royal Agricultural Society of England pitched its agricultural encampment. What a strange contrast between the half-rural, sober, slow, old English town, and the wholly commercial, bustling, gay, and tremendously "fast" foreign city,—between the one bluff English speech, varied only by district peculiarities, and the clatter of innumerable foreign tongues, and the shrug and gesture of many foreign shoulders and foreign arms! Then in the show-ground what a difference! The English show-yard was fully as large; but here were no artificial lakes and fountains, no flower parterres, no blooming shrubs, no triumphal arches, no artistic tribute to agriculture, and no decorations in its honour; no music, and no provision for satisfying the appetite of man. All these things were left to be provided for by outsiders; the yard was nothing but a great implement warehouse, a vast cattle-court and stable. It had a purely business air; but we confess our preference for the Hamburg show-ground. It would have been a great deal better for Germany, however, if there had been more of the business faculty shown in Hamburg; and we cannot but think that a little taste would conduce to the greater success of shows at home. However, no Englishman could traverse the long canvass-covered sheds of implements, and the long rows of cattle, sheep, and horses, without feeling a just pride in the superiority which the farmers of this country have obtained over those in other countries whose advantages in climate, &c. so much exceed ours. What a contrast between those glossy, soft-skinned, deep-chested, deep-ribbed, cylindrical-bodied, short-legged, erect-headed shorthorns, and the staring, hard-coated, narrow-breasted, long-legged, strong-boned, hanging-headed brutes abroad! And in the Herefords and the Devons at Worcester, and analogous animals at Hamburg, the difference was equally striking. And the pigs at Worcester seemed fully a century in advance, even allowing for Darwinian care in selection, of many of the brutes at Hamburg. In the implements, the superiority of the British manufacturer in invention and workmanship was, as we have already indicated, as much, or even more, marked. The implements and machines at Hamburg, which were not copies of British ones, were almost as ancient as the materials they were intended to operate upon. Some of the countries had been so deliberate and systematic in their piracy, that the judges passed by their stands with a contemptuous smile. The way in which the judging and distribution of the prizes was managed at Worcester was in delightful contrast to the same operations at Hamburg. At Worcester the stock was judged on Monday, the prize-list was out on Tuesday morning, and many of the awards were procurable on Monday afternoon;—at Hamburg, though judging commenced early on Tuesday, no official list of awards had been issued up to the Saturday evening following; and we understand that the list did not make its appearance until

the Tuesday—a week being thus required for the publication of a score or two of small pages, of which the Secretary declared his expectation every minute from the Wednesday morning!

The Show of the Highland and Agricultural Society of Scotland furnished perhaps a still more striking contrast than did the English Society to the International at Hamburg, inasmuch as the town selected as the meeting-place was smaller and quieter than Worcester; that even outside the ground there was no display of flags and mottoes, which were very numerous in the Worcester streets, though not on the show-ground; and that inside the yard the business air was preciser and stricter. As there were in some classes fully better specimens of shorthorns than appeared at Worcester, Kelso compared even more favourably than the former did with Hamburg; and the fine-boned, straight-backed, mild-eyed, transparent-horned, large and neat uddered Ayrshire, compared with the thick-limbed, rough-horned, unlevel, coarse-teated dairy cows shown at Hamburg, spoke volumes for the superiority of Scotch farming over that represented in the Heiligen Geistfelde. But still more did the large well-cultivated fields along the banks of the silvery Tweed and the rocky bedded Teviot speak of the energy, the skill, and intelligence of Scotch farmers over their brethren abroad, and indeed over the English farmers in the neighbourhood of Worcester; for, soil and climate being taken into account, there was no farming to be seen there like that in the vicinity of Kelso.

We have not entered into any minute account of the shows at Worcester or Kelso, or given any detailed criticism on the animals shown there, because this has already been sufficiently done in the agricultural newspapers; and the reason we have been more full with regard to Hamburg is, that the style of "get up" was unique, and that few papers have had much about it.

The comparison of the three shows has forced us to the conclusion that, while foreigners are immensely superior to us in all matters connected with the tasteful getting-up of an exhibition, they are infinitely inferior in all that relates to the essentials of practical farming. But the lessons which these international exhibitions afford will teach them how to improve their practice of farming, and in all probability it will not be very long until the foremost of them attain to a position as high as that we now occupy. Instead, therefore, of our present superiority being an excuse for resting on our oars, it ought rather to stimulate us to further efforts to maintain, and if possible to increase, the distance between us and them in the march of agricultural improvement.

MYCOPHAGY; OR, SHOULD WE EAT FUNGUSES!*

"DIVIDE and govern" is the political axiom believed to guide the conduct of him who aspires to be what old Homer styles "a king of men." The same axiom must, in another sense, control the conduct of those seeking to make themselves acquainted with the kingdom of nature, and to use the knowledge thus acquired in the advancement of science, and in increasing the happiness and comfort of their fellow-creatures. The field of observation is so immense that we are bewildered by its greatness, and lose ourselves vaguely wandering amid its wonders, until, satisfied with the comparative fruitlessness of a general survey, we set limits to our investigations, and confine them to some particular department attracting us by its importance, or by its being specially within the sphere of our knowledge or our tastes.

It is thus that men acquire precise information, and discipline their faculties for the making of new and bolder excursions into the regions of the unknown or the little understood. He that intelligently writes a monograph is the possessor of trustworthy information, for which we shall vainly look from the discursive student imitating Solomon, who "gave his heart to seek and search out by wisdom *all* things that are done under the sun." The value assigned to the researches of those known to be devoted to particular studies is manifested by the authority accorded to their opinions, and by the eagerness with which editors of encyclopædias solicit their contributions. Witlings, no doubt, make merry with the labours of the retired student spending his days in elucidating some apparently minute point in geology, botany, or natural history. But the philosopher, recognising the worth of every carefully ascertained fact, fails not to remember gratefully the names of those who have helped to rear securely the temple of science by depositing on its slowly rising walls the materials which they have painfully gathered. Very thoughtless is the wonder sometimes expressed at the enthusiasm exhibited in the exploration of some nook or corner far away from the observation of the unreflecting multitude.

"Various as beauteous, Nature, is thy face.
 . . . All that grows has grace.
 All are appropriate. Bog and marsh and fen
 Are only poor to undiscerning men.
 Here may the nice and curious eye explore
 How Nature's hand adorns the rushy moor;
 Beauties are these that from the view retire,
 But will repay the attention they require."

* 'Outlines of British Fungology,' by the Rev. M. J. Berkeley, M.A., F.L.S.; with coloured Figures and Dissections of 170 Species, by W. Fitch. 'The Esculent Funguses of England,' by the Rev. Dr Badham; with 20 coloured Plates. 'Illustrations of British Mycology,' by Mrs Hussey; First and Second Series; 140 Plates.

These lines of Crabbe we commend to the attention of those—alas! too many—"undiscerning men," who have never asked what is the use of a fungus, and who carry their ignorant contempt so far as to trample under foot, as noxious "toad-stools," numerous species of vegetable productions, not a few of which on examination are found to exhibit the most graceful forms and the most brilliant colours, as well as to supply the most exquisite odours, and abundance of the most palatable and nutritious food. "What geometry," asks Dr Badham, "shall define their ever-varying shapes—who but a Venetian painter do justice to their colours? As to shapes, some are simple threads, like the byssus, and never get beyond this; some shoot out into branches, like sea-weed; some puff themselves out into puff-balls; some thrust their heads into mitres; these assume the shape of a cup, those of a wine-funnel; these are stilted on a high leg, and those have not a leg to stand on; some are shell-shaped, many bell-shaped; and some hang upon their stalks like a lawyer's wig; some assume the form of the horse's foot, others of a goat's beard; the *Phallusim pudicus* is the very thing he calls himself. As to their colours, we find in one genus only species which correspond to every hue!" As to odours, while some smell like cinnamon, some like ratafia, and some "like the bloom of May," Dr Badham, enthusiastic fungophilist though he be, cannot discredit his nose, which is unmistakably and instinctively turned away from fungus odours yielding "an insupportable stench," "an intolerable foetor," "the savour of a stale poultice," "a smell of tallow," "the smell of putrid meat."

When our readers bear in mind that very many fungi are violently poisonous, so that Dr Badham suffered severely from merely tasting one of the spores of the milky Agarics which he had collected, they may think that there is ample justification of the popular aversion to the whole fungus tribe. We presume to differ from the popular verdict. As, in the interest of public alimentation, we lately besought favour for hippophagy, and declared that the dining on soup and stew made from horse-flesh caused us no digestive remorse, we have now entered on a course of practical mycology by eating puff-balls—*Scotticè*, "deil's sneeshin"—of which our palate much approves, and against which our stomach testified no displeasure. To eat a horse is, no doubt, much less enterprising than to feast upon funguses, many of which are virulently poisonous, and some of which vary in their qualities, so that what is safe here now may be the reverse at another time elsewhere. Although, then, as the French newspapers express it when speaking of doubtful political rumours, we must commend funguses "with a certain reserve," we nevertheless hope to interest our readers by telling of their good qualities as well as their bad, and explaining their not unimportant functions in the wise economy of nature.

Being passably honest, we hope, and not wholly without prudence, as we verily believe, we do not wish to hide from ourselves or our amiable readers that the mycophagist may pay dearly for gratifying his palate, even though his hastily summoned medical attendant may not pronounce him moribund; and therefore we have not only alluded to Dr Badham's sufferings, but now also warn those seeking acquaintance with funguses, that the mere tasting of some of them experimentally will produce contraction of the jaws, sickness, pain and heat in the stomach, as well as slight delirium. Bad may go to worse, and the unhappy inquirer may be afflicted with giddiness, debility, loss of sight and recollection, burning thirst, vomiting, fainting, and violent gripes—nay more, a man who has been poisoned by eating funguses may not know his perilous condition until suddenly made aware of it, many hours after partaking of his last fatal meal, when it is too late to adopt measures to eliminate the poison. We thus chronicle the perils of mycophagy, because Dr Badham's praises thereof are so eloquent and so witty, and the beautiful delineations of his friend Mrs Hussey are so inviting, that we fear some wanderer amid our summer fields or autumnal glades may be too rash in tasting of the lauded fungi. In fact, in a particular instance, when comparing Badham's figure of a certain species with that figured in the admirably illustrated work of Berkeley, the discrepancy was so evident that we thought it prudent to give our stomach the benefit of the doubt. Had we been more enterprising, it might have been a case of death in the pot, chronicled in the newspapers as a melancholy instance of over-confidence in a Hussey.

It must then be acknowledged that we have here an instance of the pursuit of knowledge under difficulties. With Berkeley or Badham as our "guide, philosopher, and friend," we might gain such speedy knowledge of the good and evil that are in funguses, as not to fear feasting on those recommended. But with only printed directions, however explicit, and pictorial illustrations, however faithful, we think our prudence praiseworthy in hitherto confining our gastronomical acquaintance with fungi to three varieties of mushroom, and two of puff-balls.

If some friend, practically a mycophagist, have the kindness to put into our hands the varieties of fungi which he knows to be wholesome, or if he eat of them before us in order to remove our scruples, it may be all right to "dine with what appetite we may" on what generally excites fear and loathing. It is really not safe to follow one's nose, or believe one's eyes, as the saying is. All noses are not equally furnished with olfactories, it would appear, and not a few are in some strange fashion abnormal. We know a lady who thinks candle-snuff a delicious odour! And as to following optical appearances in deciding on the edibility of a

fungus, who does not know that many of us are "short-sighted," and that a considerable percentage of human eyes are afflicted with colour-blindness? We may be told that Patagonian savages and Russian boors thrive on funguses of which we never venture to taste. Very true, we admit; but then the savage does not wear spectacles, and has "senses exercised by reason of use" in a way unknown to the civilised savant, whose artificial life does not require such absolute dependence on the reports of his perceptive organs. In a matter of mere seeing or smelling, we would follow the Patagonian savage rather than the Pope or the President of the Royal Society.

In short, like other doubtful characters, let not funguses be trusted and admitted to our tables until our doubts be removed. But caution need not be so excessive as to shut us up endlessly in insular prejudice. In the 'Gardeners' Chronicle,' edited by Dr Lindley, we are astonished to read such a sentence as this:—"We admit that we throw away many sorts that are excellent, and that we thus deprive our palate of much gratification, and perhaps that those in common use are inferior to those that are rejected. But we err on the safe side; the mushroom, chanterelle, champigny, morel, and truffle, are enough for luxury; and we trust that the peasantry of Great Britain will never be brought to the condition of Italian lazzaroni."

This looks very like "bunkum" to flatter John Bull. The question is not one of "luxury" for the favoured few who can afford to pay dearly for morels and truffles, but of food for the many. Ought we to throw away many sorts of funguses on which the peasantry of other nations feed and fatten? It is a mere popular myth that "John Bull" chiefly lives on animal food. Poor fellow! he is, as we have formerly shown, very much of a vegetarian, to which "his poverty and not his will consents."* And when by-and-by we enlighten him as to the chemical constituents of the edible funguses of Britain, we are sanguine that no 'Gardeners'-Chronicle'-inspired contempt for the lazzaroni will keep him from coveting an article of food which in savour is not merely like his national beefsteak, but, to a greater extent than anything vegetable, is actually composed of the same elementary substances. If an Italian or a Russian peasant commit wonderfully few mistakes as to the quality of fungi, can nothing be done to educate our people so that it shall be safe for them to make these productions common articles of diet? We think it more patriotic to try to solve that question than to help to keep up the silly notion that the British peasantry would sink in the social scale by so far resembling foreigners as to feed upon funguses.

* See in this Journal, 1858, article on the Physical Condition of the People.

We shall, therefore, with the help of the works already referred to, give the outlines of Fungology, and make special mention of those British fungi which are valuable as esculents.

Fungology, as a scientific term, is objectionable, because combining a Latin with a Greek word. The spurious term is, however, very generally received. The fastidious classical purist may please himself by substituting mycology, which is at once etymologically correct and sufficiently comprehensive. The word fungus may, however, in any case be retained in common parlance, only, as Berkeley beseeches, we must not display our lack of learning by speaking of a fungi, as in Phillip's 'Prize Essay on the Potato Murrain,' for this is "grating to the ear, and utterly intolerable. If fungus be considered an English word, as it is by some of our older authors, the plural will be funguses; but there is, then, something unpleasing in the sound, and the term fungi is certainly to be preferred."

Some melancholy etymologists, upon whom Badham thinks good mushrooms really thrown away, derive fungus from *funus*. The Dutch, on the other hand, from supposing, no doubt, that the devil eats the best of everything, compliment funguses with the title "Duyvel's broot."

As to the origin of the term toad-stool, Badham asks, "Have not the words *tode*, and the stool called after him, some etymological, as they have undoubtedly a fanciful, connection with the word *todt* (German), death?" Very likely, we think; but then our learned author does not perceive that his query favours the theory of the melancholy etymologists who associate fungi with funeral. "The origin of the word toad-stool," he goes on to observe, "which makes them seats or thrones for toads, does not quite satisfy me, I confess, though there be doughty authorities for it in Johnson's Dictionary, and in Spencer's 'Faery Queen'!"—

"The grisly todestool grown there 'mought I see,
And loathed paddocks lording on the same;"

and though an anonymous Italian authority declares that in Germany they have actually been seen sitting on their stools, still even in Germany it must be admitted that they do not use them as frequently as we might expect, had they been created for this end.*

* *Apropos* of toads, here is something that astonished us the other day. Taking home a little toad for the purpose of trying whether, when come to years, he could manage to live a few years without food, according to popular belief, we found him covered with loose scales, apparently of silver. Unfortunately our visions of fortune from a silver-bearing toad were dissipated by the speedy death of toadie while we were benevolently considering how to feed him. The scales are in our possession, however—a singular memorial of the defunct. Can this be the foundation of Shakespeare's

"Uses of adversity,
Which, like the toad, ugly and venomous,
Wears yet a precious jewel on his head?"

As to the plants comprehended under the general term fungus, it is not easy to give a strict definition comprehending every individual genus and species of the whole group—a difficulty the origin of which is apparent when it is remembered that it is often extremely difficult to distinguish a plant from an animal, and that the fungus family is not only very prolific, but almost cosmopolitan in its diffusion. Merely catalogued and described, there are sufficient to fill an octavo volume of nearly four hundred pages of close print of British species alone. Declining, therefore, anything like such strict definition, we shall indicate a few of the curious plants comprised in the study of mycology, with the view of affording some general notion of what it comprehends.

Taking the common mushroom as our point of departure, we have the type of an enormous group characterised by a bonnet-shaped receptacle (*pileus*) supported by a stem, and furnished beneath with a number of gill-like plates (*lamellæ*), which, when placed on paper, emit a vast quantity of dust-like bodies, to which, though reproductive, the name of spores has been given, to distinguish them from seeds which contain an embryo, while these consist of a two-coated cell without the slightest trace of an embryo. These spores are of different colours in different species, very frequently pure white, but presenting also pink, various tints of brown, from yellowish and rufous to dark-bistre, purple-black, and finally black. As these colours are accompanied by peculiar differences of habit, they afford a ready test for grouping the species, some of which have the brightest rainbow hues, combined with the most elegant and delicate forms; while others are coarse, dull in colour, and unsightly, few of them being persistent, and many, when decayed, pass into a loathsome mass, in which riot those insects which are nature's scavengers.

"The gill-bearing fungi are generally of a soft substance, but they are not all so. According to the density with which the cells or threads of which they are composed are packed, they present various degrees of hardness, till they assume even a corky substance, and are more or less persistent. The common fairy ring champignon (*Marasmius oreades*) is a familiar example of the first departure from the common mushroom type, and, in consequence of its less watery character, is easily preserved for culinary purposes. The dædalea of the birch (*Lenzites betulina*) gives a good example of the further hardening of the gills, while in that of the oak (*Dædalea quercina*) the substance is as firm as cork, or in parts hard as wood."—(*Berkeley.*)

In a very important group of fungi the spores are the essential character, as the gills are in those just described. In their multitudinous species the polypori exhibit every gradation, from great succulence to the hardness of wood. The scaly polyporus, so common on ash—the coriaceous *Polyporus versicolor*, with its

velvety pileus and many-coloured zones, so common on stumps and felled wood—and the hard hoof-shaped polyporus abounding in plum orchards—are familiar examples.

The existence of prickles, or spine-like processes, on the under side of the pileus, is the characteristic mark of a third subdivision, called *Hydnei*, after the typical genus *hydnum* (from the Greek word for truffle). The pretty *Hydnum auriscalpium*, common upon fir-cones, attracts attention from the elegance of its form and colouring ; and the esculent *H. repandum* is a common inhabitant of our woods.

The characteristic of a fourth group is the absence of projections or depressions on the hymenium or fructifying surface. The species is very common and widely diffused, and is termed *Auricularini*, from some of the most characteristic being ear-shaped. Familiar specimens are to be seen upon the oak-trunk, felled and peeled, in the form of bright yellowish fungi ; while a felled poplar, with the bark on, is adorned with a beautiful and somewhat similar lilac fungus.

Hitherto all the species described have something in the shape of a pileus ; but in the next group, that of *Clavati*—so named from their club-like form—the pileus disappears, and is replaced by a club-shaped receptacle covered with the fructifying surface. If the stem is branched, we may have every variety of tree-like form. The yellow *Clavaria fastigiata* of our meadows, and the white candle-like bundles, *Clavaria vermiculata*, so common on our lawns in autumn, are well-known examples. Here again we have the most beautiful colouring, though several of the finest European species have not yet been noticed in our woods.

The remaining group of allied fungi is distinguished by the predominance of the gelatinous element, and is that of *Tremellini*, from their soft, flaccid character. “Rotten sticks in our hedges or woods often present bright, tremulous, gelatinous masses of bright orange, purple, or dark-brown, which at once attract our notice, while the trunks of the elder and some other trees afford ear-shaped, flaccid masses, which almost escape notice when dry, but with the first shower are exposed to the most careless observer. Sometimes, again, on an old stump, or at the base of a living oak, enormous masses are found, resembling the convolute intestines of some animal, but distinguished by their rich ferruginous or yellowish tints.” A familiar specimen of the group is known as *Jew's-ear*. “These six groups form subdivisions of one great association of fungi, characterised by their hymenium being more or less exposed, and at the same time bearing naked spores attached to the lips of certain cells called sporophores. The general name of the division is *Hymenomycetes*, the hymenium being the prominent character.”—(*Berkeley*.)

The second great division of fungi is characterised by the

concealment of the fructifying surface till the containing sac is burst for the dispersion of the spores. It is termed *Gasteromycetes*. The puff-balls are the best-known example. We merely indicate its subdivisions, with popular examples of each :—

- a. *Hypogaei*—Red Truffle of Bath.
- b. *Phalloidei*—Common Stinkhorn.
- c. *Trichogastres*—Puff-balls.
- d. *Myzogastres*—Dust-fungus of tan-pits.
- e. *Nidularici*—Bird's-nest Peziza.

We next come to a large division of fungi, generally devoid of beauty, and so minute as to appear to the naked eye mere black specks upon leaves, twigs, &c. Its general name is *Coniomycetes*, from the dust-like nature of the spores. Of four of its divisions we cannot indicate any popular representatives ; but with the remaining two the British farmer is unhappily familiar, under the names of rust, smut, and mildew. The *Pucciniaei*, comprising the wheat mildew—the mehl-thau, or meal-dew, of the Germans—are distinguished by their articulate spores ; while the *Cæomacei*, containing the bunt and rust, are truly parasitic, dust-like fungi.

The next great division of fungi, consisting of those moulds which bear naked fruit, is termed *Hyphomycetes*, from their filamentous character. Its five subdivisions find popular examples in insect club-mould ; scarlet tubercularia ; carbonised moulds ; blue moulds—yeast and vinegar fungus ; and yellow boletus mould.

This terminates the first series of fungi, consisting of four divisions, in which the fructifying bodies are naked and exposed. In the term there are included other plants which differ greatly in structure, but many of which are readily recognised as true fungi, while others are very minute and obscure. These productions, instead of naked spores, have fructifying bodies (*sporidia*) enclosed in sacs (*asci* or *sporangia*). Hence fungi of the second order are characterised as sporidiferous.

The first group comprehends six divisions, whose learned names we shall not inflict on our readers, who doubtless will be satisfied to be told in plain English that these divisions are respectively represented by morel, truffle, maple-mould, candle-snuff fungus, hop-blight, and hoof-fungus. The second group, comprising two divisions, is popularly represented by felt-moulds and bread-mould.

As to the nature of the productions which have been thus classified, they are undoubtedly true vegetables in the main principles of their growth and structure, and divisible into species as definite as in other acknowledged parts of the vegetable kingdom. Berkeley therefore thinks it superfluous to consider the notions of those who regard them as the creatures of chance, or of a happy concurrence of circumstances favourable to their growth from inorganic elements. “ The notion of equivocal or spontaneous gene-

ration is now all but exploded amongst scientific men. The most careful experiments show that, without pre-existent germs, no organised beings are ever produced from such solutions as contain matter fit to nourish minute animals or vegetables, though, where proper precautions have not been taken to exclude the possibility of their access, they exist in myriads." Badham, if not so scientific, is certainly more amusing than Berkeley, and thus expresses his hearty contempt for those who fancy that his beloved fungi may originate in "spontaneous" or "equivocal generation."

"We might as well talk of the pendulum of a clock generating the time and space in which it vibrated, as of dead matter spontaneously quickening and actuating those new movements of which some of its particles have become the seat ; for how, in the name of common sense, can that which we assume to be dead—i. e., emphatically and totally without life—convey such purely vital phenomena as those of intus-susception and growth, which, by the very supposition, are no longer within itself. Life, on such a hypothesis as this, ceases to be the opposite and antagonistic principle to death, of which it then becomes but a different mode and a new phasis. At this rate, addled eggs, abandoned by the vital principle, might take to hatching themselves !"

As to the habitats of fungi, Berkeley soberly declares that it is difficult to point out any substance or situation, where conditions exist capable of supporting vegetation, in which fungi, in one or other of their forms, may not be developed. The rhetorical and facetious Badham exclaims—

"Where are they not to be found ? Do they not abound, like Pharaoh's plagues, everywhere ? Is not their name legion, and their province ubiquity ? To enumerate but a few, and these of the microscopic kinds—the *Mucor mucedo*, that spawns upon undried preserves ; the *Ascophora mucedo*, that makes our bread mouldy ; the *Uredo segetum*, that burns Ceres out of her own corn-fields ; the *Uredo rubigo*, that is still more destructive ; and the *Puccinea graminis*, whose voracity sets corn-laws and farmers at defiance, are all funguses.

"When our beer becomes mothery, the mother of that mischief is a fungus ; if pickles acquire a bad taste, if ketchup turns ropy and putrifies, funguses have a finger in it all !

"Some love*the neighbourhood of burned stubble and charred wood ; some visit the sculptor in his studio, growing up amidst the heaps of moistened marble-dust that has caked and consolidated under his saw. The *Racodium* of the low cellar (*vide* the London Docks, *passim*, where he pays his unwelcome visits, and is even more unwelcome than the exciseman) festoons its ceiling, shags its walls, and wraps its thick coat round our wine casks. The close cavities of nuts afford concealment to some species ; others, like leeches, stick to the bulbs of plants, and suck them dry ; these pick timber to pieces, as men pick oakum. They also attach themselves to animal structures and destroy animal life : the *Orygena equina* has a particular fancy for the hoofs of horses and for the horns of cattle, sticking to these alone. The disease called 'Muscadine,' which destroys so many silk-worms, is also a fungus, which in a very short time fills the worm with filaments very unlike those which it is in the habit of secreting. The vegetating wasp is another mysterious blending of vegetable with insect life ; lastly, and to take breath, funguses visit the wards of our hospitals, and grow out of the products of surgical disease."

In addition to all this, we must add certain marvels not noticed by Badham. One of the most curious properties of certain fungi is their capability of growth in substances which are in general destructive to vegetables. Tannin is one of these, and yet a tannipit is the habitat of a certain fungus ; more than one species is developed on extracted opium, and the factories in India have suffered greatly from their presence. A few years since, a little mould developed in the solution of copper used for electrotyping in the department of the Coast Survey of Washington, proved an intolerable nuisance.

The farmer groans over the mischief occasioned by the potato-mould ; the *gourmand* anathematizes the havoc which fungi make among the choicest cooked provisions ; and the rarest wines prized by the *gourmet* acquire a taste and odour rendering them undrinkable, owing to the presence of a fungus which first attacks the corks. The dry-rot is not merely the terror of naval architects, but occasionally obstructs a railway tunnel ! In Dr Carpenter's 'Elements of Physiology,' it is related that in the vicinity of Basingstoke a paving-stone, weighing 83 lb., was raised out of its bed an inch and a half by a mass of toad-stools, and that nearly the whole pavement of the town was displaced from the same cause. And as fungi sometimes occur on glass, and even on smooth metallic substances, the most recent specimens of wonderful architecture—the Crystal Palace and "The Black Prince"—may yet be doomed to furnish demonstration that neither glass houses nor iron ships are safe from the destructive effects of fungi. When we add that fungi find their way into eggs, and that in an incredibly short time they often appear in the very heart of a loaf, our readers will be prepared for the transition which we now make to the diseases caused by fungi.

Spores of fungi have been detected, apparently uninjured, in the dust of the trade-winds, in flakes of snow collected from the air, on the mucous surfaces of the internal organs of animals, and in the dejections of cholera. M. Charles Robins's 'Natural History of the Vegetable Parasites Growing on Man and other Animals' is a large treatise on the diseases occasioned by fungi ; and there are many scattered memoirs on the same subject. Berkeley thinks there is no reason to believe that they induce epidemic diseases—such as cholera or influenza—according to an opinion once somewhat prevalent ; but a curious production called *Sarcina*, from its resemblance to minute woolpacks, is a rather constant attendant on cancerous affections of the stomach ; and the influence of fungi in producing certain cutaneous disorders is now undoubted. A few spores rubbed into the skin, or inserted in it, soon produce the disease termed *Porrigio lupinosa* ; and recent experiments tend to show that this direct influence is greater than has been generally suspected. Dr Lowe has induced skin diseases by inoculation

with the granules of yeast, and is disposed to attribute a great deal more to the agency of fungi than has been hitherto allowed; and the knowledge of their influence, whether externally or internally, has led to it being counteracted by the administration of salts fatal to fungal growth.

The diseases produced by fungi on the staple vegetable food of man are chiefly referable to the lower orders of the tribe.

"The spawn, however, of higher species is often fatal to trees and herbaceous plants, by inducing decay among the roots. It has long been known that trees would not in general flourish where others had grown before, and this was attributed to exhaustion of the soil; it is now, however, ascertained that the evil arises from spawn attached to old decaying roots. A most striking instance occurred lately in the Gardens at Kew. Two deodaras were planted before the Director's house, within a few yards of each other, under apparently similar circumstances. After a time, one of these became unhealthy, and it was suggested that the roots should be examined. A scrutiny took place, when it was found that an old cherry-tree formerly stood on the same spot, that its roots were covered with spawn, and that this had extended to the roots of the deodara. The remains of the old cherry-tree were grubbed up, and the diseased portions of the deodara removed, and now it bids fair to thrive without any further check. Herbaceous plants, such as strawberries, suffer from the same cause; and it is now certain that wherever fragments of wood or sticks exist in manure, whether in the garden or field, there is considerable danger. The formidable larch-rot, which converts the trunks of larches into hollow pipes, is often attributable to this cause."—(*Berkeley.*)

Of fungi attacking timber employed in the construction of houses and ships, the most formidable, perhaps, is the dry-rot, which converts the wood into a dry powdery mass, though both it and the wood are often sprinkled with large drops of moisture. In domestic buildings, where little care is exercised in the selection of timber, the wood is often deeply impregnated with spawn before it is used; and we lately visited the house of a friend which had been abandoned after years of discomfort from the presence of this pestiferous visitant. It is some consolation to know that its attacks may be prevented by impregnating the pores of the wood with gas-tar, sulphate of copper, or some other poisonous metallic salt; and that, when established, its progress may be greatly modified by repeated washing with a saturated solution of corrosive sublimate.

Many fungi prey on the tissue of living leaves. The hop mould, the rose mildew, the vine mildew, and other allied fungi, exhaust the plant and impede its circulation, partly by feeding on its juices, and partly by clogging up its pores. Most of these yield to sublimated sulphur, if timely and judiciously applied. The modes in which these fungi are propagated are so many, however, that they spread with frightful rapidity. The cultivation of the vine in Madeira has almost ceased from this cause, and is everywhere precarious. "It is curious that this fungus

has never been found on the American vines, or their numerous varieties, when cultivated in Europe. The Isabella, for instance, a grape of American origin, has always been free from mildew. But though the varieties which are strictly American do not suffer, European kinds imported into the United States frequently suffer."

Berkeley is one of those who attribute the potato murrain to a mould whose spawn attacks the tissues in every direction, being present in the tubers and stems as well as in the leaves. Its spawn never being superficial, the sulphur remedy is unfortunately inapplicable; and for the same reason all external applications, such as lime, are equally worthless. Early planting and the destruction of the haulm immediately after the appearance of the fungus, give the best prospect of success.

It is unfortunate that the word mildew (*mehl-thau*, meal-dew) should be applied to any save the white leaf-moulds, seeing that its application to a particular disease of wheat is constantly inducing error. The diseases produced by fungi with loose, dust-like fruit, and popularly known as smut, bunt, mildew, rust, are many and most injurious; smut and bunt attacking the tissues of the seeds, their floral envelopes, or the receptacle in which the flowers grow, or sometimes the leaves and stems, converting them into a mass of loathsome, and sometimes fetid, dust; whereas mildew and rust attack the leaves and stalks more especially, forming little rusty streaks or spots, and exhausting the plant by the growth of its spores and spawns at its expense. Bunt may be easily extirpated, as the spores, being lighter than water, may be removed by simple washing, and are destroyed by various chemical compositions. The most efficacious remedy for bunt in wheat is perhaps that used in France—viz., steeping the grain in a strong solution of Glauber's salt (sulphate of soda), and then dusting it with quicklime, which coats the seeds with sulphate of lime or gypsum, and sets free encaustic soda for the destruction of the spores.

Under the name of ergot, another fungus produces disease in the grains of rye, barley, wheat, and many field grasses, converting them into a firm mass without any appearance of meal. Though useful from its medical properties, the prevalence of ergot causes cattle and sheep to slip their young, and, in addition to the fatal gangrene which it occasions in man when entering largely into bread, it is the probable cause of many diseases among cattle when they eat it in seasons during which it abounds.

We have drawn up such a heavy bill of indictment against fungi that we doubt not our readers are curious to know how the charge of irremediable mischief is to be parried or contradicted. We shall, therefore, now proceed to the uses of fungi. By their fermentative and putrefactive powers they perform important functions in the economy of nature. Decomposing even the

hardest vegetable substances, they provide a rich supply of vegetable mould for coming generations, besides destroying those structures which, having served their purposes, need to be removed. Several years ago a row of large ash-trees near our *habitat* fell under the woodman's axe: we have been interested watching the progress by which the unsightly stumps have been removed. They are yearly covered with large specimens of *Polyporus squamosus*, several of them measuring two feet across, while yearly decay makes growing inroads into the formerly solid wood, which now readily yields to a push from a walking-stick, or is converted into a rotten dust which the wind scatters across the neighbouring fields.

An important use is made of a particular condition of certain species of mould in the preparation of fermented liquors, under the form of yeast, which consists of bodies more or less oval, continually giving off joints so as to produce short, branched, necklace-like threads. These joints soon fall off, and rapidly give rise to a new generation, which is successively propagated till the substance is produced under the name of yeast. The globules of which this is composed retain their vegetative powers for months, and can be preserved in a dry state, in which form they are imported as "German yeast;" a compound of capricious deportment, inasmuch as a sudden blow is said to destroy its powers of germination. A still more singular form of mould is the vinegar plant, which, under proper conditions of temperature, has an extraordinary effect in promoting acetic fermentation.

Polyporus squamosus makes an excellent razor-strop, a fact to be noted by Mr Mechi for behoof of *gens barbata*. The German tinder, or amadou of commerce, so familiar to cigar-smokers, is made from the pileus of *Polyporus fomentarius*, beaten out and steeped in a solution of saltpetre. *Polyporus igniarius*, when pounded, is used as snuff by the natives of the northern region of Asia. When burnt, several species of puff-ball have anæsthetic properties similar to those of chloroform, so that operations have been successfully performed under its influence; and it is used in the stupefaction of bees when the object is to remove the honey without destroying them. *Agaricus muscarius* is employed, both in the fresh and dried state, in the production of intoxication, and more profitably as a decoction to destroy bugs and flies. *Cardiceps sinensis*, as stuffing to roast duck, is said to have wonderfully strengthening qualities, which, Berkeley shrewdly opines, probably reside in the savoury vehicle.

From the bright green produced in fairy-rings by the decayed fungi of last year's growth, it has been conjectured that fungi might, when abundant, form a valuable manure. If collected for this purpose, they should be filled up with alternate layers of sand or light soil to absorb their redundant moisture.

But the great value of fungi is their astonishing resemblance to animal food, and their consequent usefulness as an article of human diet. Of all vegetable productions they are the most azotised—that is, animalised—in their structure. Chemistry demonstrates that they yield the several component elements of which animal structures are made up; and many of them, in addition to sugar, gum, resin, a peculiar acid called fungic acid, and a variety of salts, furnish considerable quantities of *albumen*, *adipocere*, and *oemazome*, the principle which communicates its peculiar flavour to meat gravy.

Dr Marcet has also proved that, like animals, they absorb oxygen largely, and disengage in return from their surface a large quantity of carbonic acid, and that in lieu of the latter many give out hydrogen, and some azotic gas. Badham is eloquently vehement in denouncing our folly in rejecting an article of food the constituents of which are so nutritious and savoury; while even the calmer Berkeley regrets that in this country we should be surrounded by so large a quantity of wholesome and pleasant food, of which we cannot avail ourselves from mere ignorance.

"The common mushroom, the truffle, and morel, are valuable articles of commerce; but more especially the first, whether in a fresh state or in the form of ketchup. The extent to which this latter article is prepared is quite astonishing. A single ketchup merchant has, at the moment at which I write, in consequence of the enormous crop of mushrooms during the present season, no less than 800 gallons on hand, and that collected within a radius of some three or four miles. The price of mushrooms for ketchup, in country districts, varies very greatly in different years. In the district in which I write, it has not in the present year reached a penny per pound, while in some years as much as fivepence is readily given. In years of scarcity, almost any species that will yield a dark juice is without scruple mixed with the common mushroom, and, it should seem, without any bad consequence, except the deterioration of the ketchup. The best kind is undoubtedly made from the common mushroom (*Agaricus campestris*), and especially from that variety which changes to a bright red when bruised. That from the champignon is excellent, but so strong that it requires to be used with caution."

Even when confessing that he is not so enthusiastic a mycophagist as his friends Mrs Hussey and Dr Badham, Berkeley subscribes to their views as to the advantage derivable from the use of many species of fungi. In fact, he attributes the injurious effects frequently exhibited, not so much to their poisonous qualities as to the gluttonous appetites of those devouring them. A man after a day's fast eats a pound or two of mushrooms badly cooked, and frequently without a proper quantity of bread to secure their mastication, and is then surprised that he has a frightful fit of indigestion. Those desirous to practise salutary mycophagy must partake of the tempting vegetable beef-steaks in moderation, and eat plenty of bread along with well-cooked and perfectly sound fungi. A half-rotten mushroom spoiled in the cooking, moreover, is not "a dainty dish to set before the king;" and we may be sure

that it was not such an unsavoury morsel that, by Agrippina's directions and Locusta's cookery, had the honour to administer "the happy despatch" to the Emperor Claudius.

Knowing that perhaps no country is richer than ours in excellent fungi, more than thirty species abounding in our woods, we cannot but regret the popular unacquaintance with what Roques styles the manna of the poor. In France, Germany, and Italy, funguses not only constitute for weeks together the sole diet of thousands; but the residue, either fresh, dried, or variously preserved in oil, vinegar, or brine, is sold by the poor, and forms a valuable source of income to those who have nothing else to bring to the market. So thoroughly ignorant of all this are we, that of our Scottish readers we question if a dozen ever tasted a fungus preserved in any of those various ways by which its dangerous properties are greatly diminished. There is some excuse for this. There is no British inspector of funguses to look after the safety of the London lieges; but the "ispettore dei funghi" at Rome is an important functionary, as our readers will perceive from one of his rules for the fungus market: "The stale funguses of the preceding day, as well as those that are mouldy, bruised, filled with maggots, or dangerous, together with any specimen of the common mushroom detected in the baskets, shall be thrown into the Tiber."

We think a few species of mushrooms the only safe fungi, while at Rome their character is so suspicious that they are under a Papal bann. We have a few things to learn yet, it would appear, not from the Pope alone, but also from the Emperor of China, whose care of "the Flowery Land" is evinced in the yearly gratuitous distribution of a six-volume treatise, entitled 'The Anti-Famine Herbal.' It contains descriptions and representations of 515 different plants, whose leaves, rinds, stalks, or roots, are fitted to furnish food for the people. Not knowing the language of the Celestial empire, we cannot depone as to the funguses eaten by the omnivorous Chinese; that their number is legion we doubt not.

On the authority of Badham we state that the annual revenue of Rome is benefited by the sale of fungi to the amount of at least four thousand pounds sterling. What, then, must be the receipts from funguses throughout all the market-places of all the Italian states!

We shall indicate a few British species with which it will be for their advantage that our readers make themselves acquainted. *Agaricus prunulus*, growing in rings about the same time in spring, not in autumn, like most fungi, is generally destroyed by the British farmer, as injurious to his grass crops. In the Roman market it easily fetches 15d. a pound, and is sent in little baskets as presents to patrons, fees to medical men, and bribes to lawyers.

Tolerable proof this of its edible value ! Badham places it first in his series of plates, as the most savoury fungus with which he is acquainted.

Agaricus procerus, growing abundantly in autumn, and occasionally through the summer. Were its excellent qualities better known, they could not fail to introduce it to a prominent place in the British *cuisine*. Ketchup made from it is much finer than that from the common mushroom.

Boletus edulis, though much neglected in this country, Berkeley pronounces a most valuable article of food. "*Nihil quod tetigit non ornavit*," exclaims the enthusiast Badham. It imparts a relish alike to the homely hash and the dainty ragout. In Hungary it is made into soup. Here is the recipe : Having dried some boletuses in an oven, soak them in tepid water, thickening with toasted bread till the whole be of the consistence of a purée ; then rub through a sieve, throw in some stewed boletuses, boil together, and serve with the usual condiments.

We must not linger over Badham's savoury recipes for mushrooms. That *à la Marquis Cussi* is not just the thing for the multitude, seeing that it involves simmering in a couple of glasses of sauterne. But a homely mode of cooking "buttons" is to cut them with bits of bacon the size of dice, and then to boil them in a dumpling ; to master which with comfort would, we fancy, require the digestive vigour of a ploughman's stomach.

Agaricus exquisitus, called also the horse-mushroom, from the enormous size to which it sometimes attains (5 lb. 6 oz., for instance), is generally shunned by the English epicure ; and with reason, it would appear, for both Berkeley and Badham hold its tempting name a misnomer.

Agaricus deliciosus is in more favour with Badham, who pronounces it one of the best agarics with which he is acquainted. As it grows somewhat abundantly under old Scotch firs from September to the beginning of November, our readers may test his verdict—"firm, juicy, sapid, and nutritious."

Agaricus oreades, the champignon, or fairy-ring mushroom, is much to be commended—for two reasons, the facility with which it is dried, and its very extensive dissemination. Moreover, a three days' exposure to the air dries it ; and in this state it may be kept for years without losing any of its aroma or goodness. In the French *à la mode* beef-shops in London it is used with the view of heightening the flavour of that dish ; and it is famous for the flavour it imparts to rich soups and gravies.

Cantharellus avariis.—Battara, in his '*Fungorum Historia*,' confesses that some think it pernicious ; but he depones that he has eaten it greedily, and insists that, made into soup, it will revive the dead ! "The very existence of such a fungus at home is confined to the freemasons, who keep the secret ! Having collected

a quantity at Tunbridge Wells, and given them to the cook at the Calverley Hotel to dress, I learnt from the waiter that they were not novelties to him; that, in fact, he had been in the habit of dressing them for years, on state occasions, at the Freemasons' Tavern. They were generally, he said, fetched from the neighbourhood of Chelmsford, and were always well paid for. Of the *cantharellus*, this summer, the supplies were immense."—(Badham.) *Morchella esculenta*, or the morel, is the expensive luxury which the rich procure at great cost from the Italian warehouses, and the poor are fain to do without. And yet it is not infrequent in our orchards and woods during the beginning of summer. Roques reports favourably of some specimens sent to him by the Duke of Athole; and others from different parts of the country occasionally find their way to Covent Garden.

Fistulina hepatica, "the poor man's fungus," as Schöeffer calls it, deserves, indeed, the epithet, if we look to its abundance and its enormous size, Badham having picked a specimen weighing 8 lb. But it merits attention from all lovers of good things, for no fungus yields a richer gravy, and when grilled it is scarcely to be distinguished from grilled meat.

But we must desist, our savoury theme not half discussed. The question for our readers to decide is, shall they feast upon funguses, or fast out of mere prejudice, with the despised bounties of Providence surrounding them in profusion? But there are not a few, peradventure, who will both study and eat funguses. The doing of both with advantage may be insured by carefully perusing the works now introduced to their notice. Mrs Hussey's splendid work evinces her rare powers of pictorial delineation; Berkeley is an authority in scientific mycology; while Badham, being both Reverend and M.D., is learned, witty, and jocose. Knowing the seductiveness of Fungal fare, he not only prescribes medically in the case of accidental poisoning, but also preaches moderation like a Christian divine. Listen, O reader, and it shall be well with thee! "Nine-tenths of dyspeptics become so from over-feeding. Whilst it is an acknowledged fact that infants are over-fed, and that all children over-feed, men are by no means so prone or willing to admit that gluttony is perhaps the very last of childish things that they are in the habit of putting away from them. But, then, though funguses are not to be considered unwholesome, they are, like other good things, to be used with discretion, and not '*à discretion*.'"

THE SUPPOSED PROGRESSIVE DECLINE OF IRISH PROSPERITY.*

SOME cavillers have asserted that Irish prosperity is progressively declining, and this they have maintained in a vituperative tone, especially directed against the Lord Lieutenant of Ireland, whose high repute for integrity and general benevolence ought to have secured this distinguished nobleman from ungenerous imputations, even if his high station as a ruler of the people did not entitle him to respect.

It appears, from the first page of the pamphlet about to be noticed, that Dr Neilson Hancock, of the Irish Bar, received the Earl of Carlisle's command to investigate "some of the statements as to the supposed progressive decline of Irish prosperity, with a view to ascertain the real truth as to the state of the country," and to report upon them. The pamphlet is the result of his investigation. It comprises a great mass of important details, arranged in a masterly manner, expressed in plain and perspicuous language, with logical accuracy, and addressed to Major-General Sir Thomas A. Larcom, K.C.B., Under-Secretary to his Excellency the Lord Lieutenant. The first portion, containing seventeen pages, relates to the decrease of population in Ireland, with some of its results as they affect Great Britain, where the population has increased within the same period—twenty-one years—partly in consequence of an immigration thither of upwards of 400,000 persons from Ireland previous to 1841, and of 300,000 more in the ensuing decade. Without pursuing the course of statistic details before us with arithmetical precision and order, we admit the inference drawn by Dr Hancock from his detailed statements, that 40 per cent of the Irish population, from 1851 to 1861, is attributable to migrations from Ireland to Great Britain during that period—such migrations being obviously beneficial to those who migrate and to the labouring classes left in the mother country.

We can only give a summary of the leading points contained in this and other portions of this comprehensive publication. The wretched state of the Irish population before the famine is shown from official reports; that it had not improved up to the famine period is proved by the report of the Land Occupation Commissioners in 1845, when the population was at its highest amount—the inference being, "A mere increase of population is no proof of prosperity; and if so, it is idle to argue that a mere decrease of the population is necessarily an evidence of decline." The failure of the potato crop is universally known to have been the primary cause of the diminution of the population. The statistic tables presented, show that emigration had been going on previously to 1841,

* 'Report on the Supposed Progressive Decline of Irish Prosperity.' By W. Neilson Hancock, LL.D. Dublin: Alexander Thom, 87 and 88 Abbey Street.

and at an accelerated rate before 1846 (caused by insufficiency of wages at home, and consequent misery), which proves that there was not much prosperity in Ireland amongst the peasantry before the famine period. Emigration was recommended so far back as 1836 by the Commission for Inquiring into the Condition of the Irish Poor. The remittances from America (especially) show the voluntary character and beneficial effects of the emigration; and when the Irish population in the United States and in Australia are so prosperous, it is idle to deplore emigration as necessarily a calamity. The increase last year, and even this year, notwithstanding the continuance of American warfare and its concomitant horrors, is a proof of pressure from the unfavourable seasons of 1860 and 1861. "Should more favourable seasons return, and should a better understanding prevail between landlord and tenant, so as to insure a farther increase in the rate of agricultural wages, and a greater stability for farming profits, we may expect the emigration from Ireland to assume gradually the same proportion to the population which prevails in the emigration from England and Scotland." What would be the condition of Ireland now, after three successive seasons of comparative unproductiveness, if its population were numerically what it was at its maximum (upwards of eight millions) in 1841? If the now diminished class of small holders are suffering privations and difficulties, what would be the general condition of the country if they were more numerous by nearly two and a half millions—the amount of actual decrease within the last twenty years? They were obliged to emigrate because they could not derive the means of subsistence from their small holdings in unfavourable years, and when there was no progress in agriculture sufficient to afford them remunerating stipendiary labour. Could such a multitude even now prosper in Ireland? The decrease of the Irish population has certainly promoted the material progress, not only of Ireland, but of the United Empire; and a benevolent regard for the class in question, apart from the considerations affecting the general prosperity of the country, would point to the adoption of the policy that has been actually pursued.

As the extent of land under culture at the present period is greater than it was in 1847, when the population was so much above the present number, and far better cultivated, with fewer labourers, it is clear that the former numbers were redundant, and cumberers of the land, under the demoralising influences of semi-idleness, and so satisfied to subsist on potatoes, that they had no desire to better their condition. If the old wretched system of living from hand to mouth on paltry patches of miserably tilled soil, and in hovels unfit for human habitations, were still existing in its former extent, there could be no accumulation of capital among that multitudinous class—no improvement of their land to any perceptible degree—no incentives to sustained exertion when the

supply of labour in the market was so much in excess of the demand. The potato blight only hastened a crisis which, in the natural course of events, must have resulted from the numerical excess of the class in question. We are reminded by the writer before us that "the causes which have led to such a large migration to England and Scotland, and such a still more extensive emigration abroad, have affected the people of Ireland alike, whether descended from native Celts or from English or Scotch settlers. The causes must therefore be general, and it is impossible to ascribe to them any policy of the Legislature or of the Government directed against a particular race or creed." Some absurd and unreasonable clamour had been raised by a few malcontents against Lord Carlisle, because his Excellency had said, at an agricultural meeting, "Consolidate the small farms, and reduce the number of holdings"—a sentiment which has been held by every man capable of taking a statesmanlike view of the condition of Ireland. His Excellency did not suggest consolidation by harshly ejecting the poor occupiers without providing employment for them, or means of ameliorating their condition. Even the most benevolent observers of facts as they existed would have indorsed the sentiment as worthy of acceptance and currency, knowing that the poor occupiers of very minute land-holdings are generally in danger of destitution when bad seasons occur, and at all times incapable of applying the means which would render their land fully productive.

The alleged decline in the quantity of land under cultivation is the next point treated of; and to disprove the assertion that "the policy of the State for some years has been to destroy tillage, by which the poor lived, and to promote an undue extension of cattle-farming," several statistical tables are adduced which show the total number of acres under crops of all kinds, and the various sorts of crops respectively from 1847 (when the collection of statistics commenced) to 1862, showing the increase or decrease in each year. From analyses of these tables, the information obtained is as follows:—The number of acres under crops of all kinds increased (although varying in different years) from 5,238,275 acres in 1847 to 5,970,139 in 1860; subsequently there has been decrease, but there were upwards of 500,000 acres more under crops in 1862 than in 1847. Wheat culture has declined from 743,871 acres in 1847 to 357,816 in 1862, which is a natural result of the often-experienced inferiority of the climate of Ireland for wheat-growing, and its much greater suitability to other crops: "it is the crop of all others in the growth of which the country has the least natural advantages, and which can be most easily replaced by supplies from abroad." No notice is taken of barley, which is of very limited cultivation. The acreage under oats has varied very little during the same series of years. In 1847 the extent

was 2,200,870 acres; in 1862, a fraction less than 2,000,000; and it has been nearly the same during the last seven years. The decrease in cereals has been concurrent with the increase of potatoes, which makes the number of acres under cereals and potatoes together little less than it was in 1847. There has been a slight decrease in potatoes during the last three years. "There has been a great decline in *produce* since 1859, and something quite startling in 1861, when it was far below a third of the average produce from 1851 to 1855, and below a half of the average produce from 1856 to 1860." In the present year it will be found that the productiveness of the potato has advanced to a very high rate, and perhaps it is well that the reappearance (though in comparatively slight degree) of the blight should check a disposition to a more extended culture of this esculent; for, if a remarkably favourable season for planting the tubers at a very early period in the year had not occurred, and early maturity ensued, there would probably be much greater failure, even in this autumn, wherever blight has appeared. The crop has escaped general disease owing to the contingencies of very early planting, of the absence of spring frosts, and the good influences of a warm summer to ripen the crop before the usual period of the morbid influences, which have been hitherto so baleful.

The acreage of turnips in 1862 was little more than that in 1847, and not much in excess of the acreage in 1853—being less than 400,000 acres—the maximum extent within the period of sixteen years. There has been a falling off in rate of produce of turnips since 1858. The tables of produce for the last seven years show a great decrease of weight in all the foregoing crops, which is undoubtedly the effect of unpropitious seasons. The deficiencies are not fairly attributable to inherent national decline.

Great efforts are being made, in the south of Ireland especially, to promote the culture of flax, which has increased from 1849 to 1862 (with a large increase in the present year above the preceding one), yet the total is very insignificant. It is a question how far the falling off of the supply of cotton may affect the home growth of flax. The extension of the linen trade, which affords Ulster such a source of employment and commerce, may follow; but the general culture of flax cannot profitably supersede that of cereals where the soil is congenial to the latter. In sharp, lively, and comparatively poor soils, flax-growing ought to be encouraged; and in order to effect this, the best course would be, for landlords, who can better afford than their tenants to make experiments, to set the example by cultivating flax on some portions of land under their own management. Their experiments, if successful, would be soon followed. Small tenant-farmers cannot be expected to risk losses on the raising of a crop with which they are not familiar. The erection of flax-mills in various

localities would follow as a natural consequence of the supply of the raw material.

We now come to the subject of Live Stock.

On examination of the tables, we see that the Census Commissioners estimated the value of live stock, descending even to goats and poultry, at upwards of £21,000,000 in 1841. In 1849, when statistic returns commenced, the value was under £25,000,000. Advancing to 1857, and estimating horses, cattle, sheep, and pigs only, we learn that the value of them in that year (the maximum amount at any period since 1841) was £35,368,259, and that there has been a decrease since to £31,204,325 in 1862. This at first view is alarming, but the decrease is only an apparent one (until the last three years of actual decline from the bad seasons, and the pressure upon the agricultural community in consequence), as is thus demonstrable. The Census Commissioners in 1841 rated the average of cattle, for instance, at £6, 10s.; and the same scale was adopted in 1847 (the true starting-point of all the returns), and has continued as the standard scale of value in all the returns made by the Registrar-General to the present time. Dr Hancock's statement is so clear and convincing, and so important in its matter, that we give this paragraph unabridged:—

"It has been estimated that the average weight of Irish horned cattle sold in the London market rose from 640 lb. in 1839 to 736 lb. in 1860. The price of prime beef in the Christmas market in Dublin in 1844 was about 45s. a cwt.; in 1860 it was above 60s. per cwt. The effect of these two causes together would raise the average value of cattle from the £6, 10s. assumed by the Census Commissioners of 1841 to nearly £10. On reference to the table it will be seen that there was a constant increase in the total value of live stock in each year from 1847 till 1859, from £24,820,547 in 1847, to the maximum amount, £35,368,259, in 1859. If we allow the increase in weight and value, and assuming that pigs and sheep increased in these respects as well as cattle, and to about the same extent, the maximum value of live stock in 1859 will be about £53,000,000; thus proving that there was great increase of wealth, as indicated by this test, till 1859. The table no less conclusively establishes a serious decrease in wealth, as tested by the value of live stock, in every year from 1859 till 1862; and the rate of decrease has been, it will be observed, much more rapid than the rate of increase—the value decreasing as much in three years as was gained in six."

All the instances of decrease of prosperity we find to have originated in calamitous seasons alone; and as the recent Acts of Parliament for promoting drainage of land and other material improvements are likely to give increased impulse to agriculture, progress may be hopefully anticipated; and favourable seasons may soon enable the farmers to recover from their recent losses. Most of the floating capital of cultivators (frequently live stock) has been exhausted during the last two years by the payment of their rents. In some instances wealthy and generous landlords have munificently assisted their tenantry, even without sollicita-

tion or thought of receiving abatements; but more frequently landlords have been severely crippled by the embarrassments of tenants, and unable to forego their claims of rent. Dr Hancock computes the losses on three years' crop to have been about two years' rental. The purely agricultural rental he estimates to be £13,000,000, and the losses to have been as follows:—

“From July 1860 to July 1861, £45,444,147; from July 1861 to July 1862, £10,360,049; from July 1862 to July 1863, £12,109,750—not including some losses from the bad turf crop in 1861. The losses have, in point of fact, been met since 1859 by a sacrifice of live stock (the floating capital of farmers), which has been reduced to the extent of £6,000,000 by intercepting the usual amount of deposits in joint-stock banks, which has taken place to the extent of £2,250,000; by the withdrawal of deposits to the extent of £1,750,000; by sales of Government Stock to the extent of £2,000,000; by a diminution of expenditure on clothes and such comforts as may be curtailed in times of pressure; by borrowing what could be obtained on credit; by reducing the employment of labourers; and, lastly, by allowing rents to run in arrears, or by getting abatements from landlords.”

The state of the labouring classes is not passed over. Details are presented of the successive phases of their wretchedness from 1825 to 1862, concluding with the assertion that there has been a marked improvement in their condition up to 1859, with some pressure on them subsequently from the losses sustained by farmers. No doubt their condition is much improved; but though their number has decreased so much, from mortality and emigration, the wages, even of good labourers, is not sufficient to raise them above the want of occasional relief, as administered under the liberal and humane system of English poor-laws, and harshly denied by the Irish system. No decent and respectable labourers will enter a poorhouse, even in extremities; and out-of-door relief is disallowed, except in rare cases. We hold to our often-expressed opinion, that the workhouse is not a true test of poverty; and we thank Dr Hancock for stating, that “if poor relief were administered on the same principles in Ireland as in England, so as to make the statistics on this subject comparable in the two countries, the distress, as indicated by the test of the numbers relieved in Ireland, would appear much greater than at present shown.” But why are not the systems assimilated, at least in the cases of sickness, old age, infirmities, and widowhood? Why is the present system, though expensive, so little beneficial in a general sense?

We must glance, in conclusion, at the financial condition of Ireland as regards depositors in joint-stock banks (in which farmers are supposed to be the most numerous class of depositors) and savings' banks, from 1840 to 1862. The tables show that the private balances in all those banks rose from £5,567,851 in 1840 to £16,042,140 in 1859; then succeeded a decrease, as might be anticipated, in each of the three last years in the following grada-

tions ;—£432,903 in 1860 ; £604,172 in 1861 ; and £616,340 in 1862. The aggregate of these withdrawals—viz, £1,653,315—“ is not much below the £1,949,009 withdrawn in 1847—the only year in which withdrawals took place after the famine.” “ These deposits indicate, too, that any neglect in executing the more lasting agricultural improvements cannot arise from a general want of capital amongst those connected with land in Ireland ; and it is a matter of grave inquiry why the farmers of Ireland should lend such large sums to the different banks, at an average of two per cent, to be employed in the large towns, and much of it in London, instead of expending it in agricultural improvements in Ireland.”

Public confidence has been so shaken by the failures of two or three savings banks in 1847, that depositors of money have subsequently been more disposed to invest in Government securities ; the amount, however, in the savings banks in 1860 was £2,143,082. The subsequent decrease does not appear.

The continued extension of railways is one of the subjects on which the agricultural community of Ireland must be heartily congratulated ; they are progressing, and will progress even in the next year, to a marvellously beneficial result to the localities about to be opened, and to the furtherance of national prosperity. Earl Fitzwilliam, as one instance, has given land for twelve miles through one of his estates, out of a line of sixteen miles, and undertaken to settle with all the tenants for their claims, free of cost to the Company, and contributed £1000 to the expenses concerned in this branch line ; which will open communication from a large (and much of it hitherto unproductive) district directly with the metropolis. Even the drainage which such a work induces, besides the facility obtained of forwarding agricultural products to Dublin or elsewhere, must be conducive to the prosperity of landlords and farmers. With great satisfaction we learn that the capital of the country has increased (as demonstrated from the statistics) from £60,000,000 in 1841 to £120,000,000 in 1859 ; the decrease in the last three years has been about £8,000,000, but the next reports will, we confidently trust, record a strong influx of tidal prosperity.

Dr Hancock has not in any measure smoothed over the painful fact, as expressed in his own brief and emphatic words : “ That the still further produce of all crops in the last three years, resulting from inclement seasons, with scarcity of turf in 1861, turned the disinterested progress in wealth into a positive decline ; and that the accumulation of the effects of three years’ decline has produced a very serious diminution of national wealth and wellbeing—the losses of farmers in three years amounting to upwards of £26,000,000, or two years’ rental.”

We take leave of this really clear, honest, and instructive pamphlet, in the words of the last paragraph of general con-

clusions: "The losses in these years, though affecting indirectly all classes, have mainly produced pressure on the farmers, entitling them to a large amount of sympathy and consideration; and the labouring classes, owing to the rise in wages, increase of employment, and abundance of foreign wheat and Indian corn at a low price, are suffering much less than was commonly anticipated."

AGRICULTURAL SUMMARY FOR THE QUARTER.

IN the summary for the corresponding quarter of last year we had to announce that the harvest was one of the latest on record, and that the crops generally were very deficient in quantity and not so good in quality; this quarter we rejoice to have it in our power to say that the harvest is very much sooner than usual, fully a month earlier in most places than it was last year; that the crops generally are above the average, and the quality, of barley especially, such as has never been surpassed, if indeed equalled, in Scotland, colour and weight being both taken into account. On several farms we have heard of, the last rig of corn was being cut this year on the very day that a beginning was made in 1862, and most of the stacks will be in the stackyard in early districts before the date at which the first one was built last year. The want of rain in the spring retarded the growth of the hay crop, which has turned out rather a thin one on the whole. The lack of moisture in July, following after some genial showers in the early part of June, also injured pastures considerably, making them quite brown in some quarters, and seemed to damage the prospects of a full crop of straw in cereals. About the third week of July rain was very anxiously longed for by agriculturists, both on account of the potatoes and the turnips, the latter of which were threatening to be a poor crop. An unusually sharp frost about this time also did considerable damage to the potatoes in several districts. At the end of July matters remained much in the same way, the white crops appearing to suffer from the strong noontide heat and the cold north winds at night, and the green crops to languish for want of rain. The fear that the turnip crop would not be up to the average was at this time almost universal. In the early part of August there were partial showers, but the drought had been too great previously to admit of a passing shower penetrating the ground and refreshing the roots of plants. Indeed, as a general rule farmers at this time were afraid that the early promise of the season was not likely to be realised, either in cereals or in green crops. During the second

week of August, however, we had some fine showers, which quite put a new face on the turnip fields, and did good to every other crop. Cutting was pretty general about the first week of August in some of the earliest districts of the Lothians. At this point harvest was somewhat retarded by strong winds and heavy showers, which partially laid the fields and did injury by shaking. The weather now continued broken up to the end of the second week in September, but it was not so consistently bad as to put an entire stop to field work, though it caused many broken days, and prevented the leading of that which had been previously cut. Where the corn was not cut it was in a good many districts laid and twisted considerably, and shaking here and there took place to a large extent. Fears were also entertained that much harm would result from sprouting, and that the colour of the grain would suffer great deterioration from the wet, but this, fortunately, has not turned out to be the case to any extent. Some of the farmers, very eager to get their corn under "thack and rape," led at a much earlier hour after the rain than prudence would have seemed to warrant; but thanks to the fact that the sunshine following the rain was not fervent, and that the wind was very drying: "heating," so far as we have heard, has this year been as uncommon as sprouting or discolouration, beyond the mere outside pickles. Without entering into any detail as to the crops in Scotland, it may be stated in general terms that the cereal crops are a full average in almost all localities, while others can boast of even more than that, and that the quality is vastly superior to what it usually is. This is especially true of barley, which is likely in consequence to meet with a good sale for malting purposes this year, brewers, we believe, generally preferring the home product for their beer, when they can get it good, to the foreign commodity. Potatoes will also yield a great deal better than it was at one time expected they would do, and there is, so far as we have heard, little or no complaint of disease. In East Lothian, however, the late rains have had the effect of inducing a parasitic growth of small tubers upon the larger root. Some potatoes have been picked up with no less than fourteen of these marble-like off-shoots depending from the parent stem, and we have ourselves seen some with eight or nine. Turnips have picked up amazingly, and, save in exceptional instances where they ought to have been ploughed over long ago, the crop will be at least a good average, proving how groundless were earlier fears. Beans have been very good.

In England the crop has been a particularly good one, all the white crops yielding well, and the whole, save in some of the very late districts, has been well gathered. How much the crop exceeded that of last year will be gleaned from the following tables, which have been published in the 'Agricultural Gazette':—

Crops 1863	Over Average	Average	Under Average	Total Reports	Crops 1862	Over Average	Average	Under Average	Total Reports
Wheat,	131	60	1	192	Wheat,....	1	37	150	188
Barley,	58	109	23	190	Barley,....	26	108	53	187
Oats,	49	110	40	196	Oats.....	37	108	55	200
Beans,.....	24	77	48	149	Beans,.....	42	80	13	135
Pease,	29	82	10	121	Pease,	10	73	23	106

Wheat prices, however, notwithstanding greatly diminished imports, still remain very low, while stock rules high. Sheep and wool in particular have been profitable during the last season, and many farmers are seriously contemplating diminishing their corn acreage, in order that they may have more grazing. The old question of "Plough less and graze more" is likely to form one of the most interesting topics of consideration and discussion among farmers for some time to come. The agricultural journals have taken this matter up, and in the 'Scottish Farmer' we notice a most interesting article on the subject, evidently from the pen of a practical farmer. The writer, in reference to the objection that less ploughing implies less straw, argues that that by no means follows, as we may reasonably look for larger crops after a judicious and liberal pasturing. And, besides, he contends that by proper buildings the straw for stock could be economised to a much greater extent than it is at present, and that, under an intelligent system of managing dairy stock, the farmer in the neighbourhood of towns would find it more profitable to feed off the produce of their farms at home by milch cows than to sell it and after have to purchase manures, which practice necessitates a double cartage, not required when cows are kept. With regard to another argument against the discontinuance of the use of the plough—viz., that a great extent of the land now broken up in regular rotation would not prove profitable in pasturage—the writer remarks:—

"Our own experience has proved the truth of this both in land worth not more than 15s. per acre and in some rented at 50s. per acre. We have been successful, at the same time, in having good and improving pasture in soils of both the above descriptions for more than four years; in one instance, the field worth about 50s. per acre has been pastured now for ten years. In this case, cake and grain were consumed by sheep on the field for the first two years after it was sown out—the grass became so very luxuriant that it was considered advisable to discontinue the use of extra feeding. In four or five years after there was an evident deterioration of the grass, which became *fogged*. As a remedy, cake was again resorted to, and in two months in spring, when there was a scarcity of grass, half-bred ewes and lambs were allowed at the rate of 1 lb. of rapeseed cake and 1 lb. of linseed-cake for each ewe per day. The first year there was an immense improvement in the grass; the increased profit from the ewes paid for the extra feeding, and the improved pasture was got into the bargain. Every year we have practised the same plan with profit, and under particular circumstances the use of cake is continued throughout the summer. On another field, the soil of which was not worth more than 15s. per acre before it was improved, and which was

noted for the rapid deterioration of the grass on it, turnips and cake were eaten by sheep for some months in winter, the whole stock being removed by the beginning of March; and if it was necessary for the stock, more cake was consumed by it in summer. The result of this treatment has been that both the soil and the pasture have been greatly improved.

"While we advocate more land being in pasture, we would insist upon the pasture being made to keep more stock. We have indicated one mode of doing this by giving the stock cake or other auxiliary food on the grass. When this practice is pursued judiciously, there can be no doubt that it is remunerative, both from the increased value of the stock and the improved condition of the soil. So long as the relative prices of stock and feeding stuffs continue as they are, it will be found profitable to use the latter on grass, more particularly for stock in condition. We would, however, recommend the use of feeding stuffs with caution for lean stock, particularly those low in condition. The same profit would certainly not be derived from them as from the others. The great desideratum at present is cakes of various qualities to be given to stock of different degrees of condition. To economise the grass so as to enable it to keep more stock, we should have a cake which combines bulk with nutrition—that is, if we wished to give a certain amount of nourishing matter to an ox, we should have it in our power to give it, say, in 6 lb. daily, rather than in the more concentrated form of 3 lb. Of course, the fatter the cattle—the nearer they are to maturity—the more need that the food should be given in a more concentrated form. One great advantage in using cake on the grass is the keeping of the stock always in a progressive state. Most farmers are aware that the feeding quality of the grass varies with the soil of the fields. For example, on one field we found that the gain in some lambs which were accurately weighed, was at the rate of 1 lb. per day each while the experiment lasted, while on another field it was only $\frac{1}{2}$ lb. In changing the ewes and lambs from the good to the inferior field, it would therefore be advisable to give them extra feeding to maintain the same state of progress as they were in the first field.

"It has been frequently observed that there has been a magnificent appearance of clover in the autumn after the grain crop has been cut, but that in spring it had all disappeared. The question which naturally occurs to us is, Do we manage our grasses right? The answer to this question brings us to make a few remarks on the second mode of keeping more stock on grass. We have shown that this can be done by the use of extra food; and we propose that it should be done also by the application of auxiliary manures to the grass. The profitable results of applying bones to pastures are too well known to require any lengthened remarks here to recommend the practice. We are told of instances where the 'annual value of our poorest clay soils has been increased by an outlay of from £7 to £8 an acre at least 300 per cent.' Such instances are known to ourselves from the profitable application of bones to our own soils and to those of our friends. The reason of our allusion to this subject is to suggest the application of bones or other phosphatic manures to our young grasses in autumn, immediately after the removal of the grain crop."

Agricultural Shows.—During the past quarter the agricultural exhibitions have been very numerous, more so, we think, than usual; shows being got up now in the smallest district. It may be matter for doubt whether so many little local efforts are so well calculated to promote improvement in stock as would be an exhibition of larger dimensions, under the auspices of a united committee representing many neighbouring districts; for this reason, that often

there is little or no competition in various classes at these small country shows, and yet the winner of a prize often prides himself as much upon his pound or his medal as if it had been won under the most difficult circumstances; and what is still worse, as being likely to interfere with any effort to attain greater excellence, he is apt to imagine that the beast which gained the prize approaches very nearly to perfection. Of course it may be argued that these shows are a sort of training-schools for larger exhibitions, which may, to some extent, be true; but as a general rule the prizes are too insignificant to tempt out the best animals from the best breeders, and yet they are large enough to diminish the amount of prizes which united shows could otherwise offer. The best argument for their continuance, perhaps, is that they afford the farmers a pleasant holiday which they might not otherwise have. As a whole the stock shown at these tiny exhibitions does not appear to have been so extensive this year as usual, but there does not seem to have been any deterioration in quality. At larger shows there has not been noticeable quite so much forcing among breeding animals as we were wont to see a few years ago, but still there was far too much of it. There were some disgustingly obese specimens among the Herefords at Worcester; and the prize heifer belonging to Lady Pigot, as well as that belonging to the Duke of Montrose, were, to draw the matter as mild as possible, not in that state they would have been in had they been meant entirely for useful purposes and not for exhibition. Almost the only place where shorthorns appear in any number in a natural state is at the Royal Northern at Aberdeen. There the breeders really appear to think more of a bull that will get stock and a female that will yield progeny, than animals that will merely take a prize. The principal shows this year were Hamburg, Worcester, and Kelso, to some account of which an article is devoted in another part of the 'Journal.'

Discussions at Agricultural Meetings.—In the quarter between July and October farmers are too busy with shows and harvest to spend time in discussing questions bearing upon the farming interest. There have, however, been two or three interesting papers read and speeches made upon them. The *Teviotdale Farmers' Club* have been discussing the propriety of long leases, which would seem to be almost superfluous in Scotland, all farmers north of the Tweed, we imagine, being pretty well satisfied that improvement in the land and independence of social and political action are only to be thoroughly secured by a lease extending over not less than nineteen years. All the members of the club were at one in the belief that leases for arable lands should be from nineteen to twenty-one years in length, most of them being in favour of the longer period, and that the lease of pastoral farms should not be shorter than fifteen years. In no shorter periods could the farmer hope to receive a profitable return for the outlay of necessary capital. The

Galashiels Farmers' Club discussed the diseases of sheep in a practical manner; and Mr Mechi has been lecturing the farmers in Cumberland on the excellence of feeding stuffs, by increasing the nutriment in grass and turnips. The *Royal Agricultural Society of England* had a good lecture from Professor Voelcker on manures for grass lands, involving questions which it would be out of place to discuss in this part of the Journal; but our readers will find an elaborate article on the subject elsewhere; and the *Borough-bridge Agricultural Association* had before them the question of the condition of agricultural labourers, introduced by a clergyman, who advocated that farm-servants should be hired by the week instead of by the year or half-year—a proposition which is not likely to meet with much favour in Scotland.

Agricultural Statistics.—This question has formed the subject of after-dinner speeches at one or two of the English shows; and if we are to credit the opinions there expressed, it will not be long before we have a measure for securing the collection of these valuable facts in connection with our agricultural history. Those who previously objected to a bill in Parliament now declare that neither themselves nor those they represent are opposed to supplying the much-desiderated knowledge.

Destruction of Wood-Pigeons.—The Committee of the United East Lothian Agricultural Society have a good report to make of their efforts during the last season for the abatement of this nuisance. They have destroyed no less than 12,493 birds, and eggs to the number of 1847. This work has been accomplished at an expense of £107, 19s. 2d., subscribed by the farmers in the county, and the money without doubt has been well expended. These birds are so frightfully voracious that there can be no doubt that, if allowed to live, they would have consumed far more produce than the equivalent of this sum. But the number killed by no means represent the good that will ensue to the farmers through their destruction. If allowed to live, each of these birds might have been the parents of two or three others, which would have swept down on the farmers' crops next year. Then, again, others have been frightened away by the deaths of their fellows from the fields of East Lothian. About Dalkeith, we believe, a good deal has also been done to thin the ravages of these pests; but it is to be regretted that landlords even in East Lothian do not take so much interest in the matter as they ought to do. In other districts both tenants and landlords seem to be apathetic about the matter. Such apathy sadly hinders the benefits that would accrue to districts where the work of destruction is pursued with such energy as in East Lothian. The East Lothian Committee, we notice, makes an earnest appeal to farmers in other parts of the country to co-operate with it; and if they have true regard for their own interests, they will not turn a deaf ear to the call.

Steam-ploughing.—The competitive trials of steam-ploughs which have taken place this year have ended, as all former competitions of the same kind have ended, in the first prizes being awarded to Mr Fowler. The excellence of steam-cultivation is now becoming appreciated by almost all farmers, and numerous sets of tackle have been purchased this year from Mr Howard and Mr Smith, as well as Mr Fowler. Indeed there is every prospect that one system or another will, ere many years pass, be at work on all suitable farms whose tenants can afford the outlay. One of Howard's apparatus has been purchased by Mr Hope of Fenton Barns, making the third steam-plough in East Lothian.

Steam-ploughing in Ayrshire, we regret to learn, has proved a failure ; but this seems wholly attributable to the manner in which it was worked, in unsuitable weather, and on small stony fields. It was a plough for hire, and, as a matter of course, every farmer wanted it at the same time, and not being able to get it, did their work in the old way. The consequence was that the plough had only some sixty days' work during the entire year. Steam-ploughing to be made profitable must be entirely under the control of the farmer who employs it—must, in fact, be his own property. A company in London, numbering some well-known and respected names in agriculture, foreseeing this, proposes to purchase tackle for farmers who cannot afford to lay out the price all at once themselves, repayment being taken in instalments. The company, we believe, is not yet strong enough to commence business ; but its object is undoubtedly good, and as its operations are sure to prove profitable, it deserves the support of the agricultural community.

AVERAGE PRICE OF THE DIFFERENT KINDS OF GRAIN,

PER IMPERIAL QUARTER, SOLD AT THE FOLLOWING PLACES.

LONDON.							EDINBURGH.						
Date.	Wheat.	Barley.	Oats.	Rye.	Pease.	Beans.	Date.	Wheat.	Barley.	Oats.	Pease.	Beans.	
1863.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	1863.	s. d.	s. d.	s. d.	s. d.	s. d.	
June 6.	47 10	32 2	31 1	32 0	43 6	36 8	June 3.	44 4	29 1	28 4	40 6	41 8	
13.	47 9	31 9	28 9	32 6	38 4	32 5	10.	44 11	28 11	28 11	41 6	42 7	
20.	48 6	31 6	21 0	33 0	36 10	38 11	17.	43 10	27 7	28 6	39 6	40 11	
27.	47 5	32 8	22 0	33 6	40 2	35 11	24.	42 9	29 2	27 11	37 0	37 9	
July 4.	48 8	31 8	30 0	32 8	43 6	40 4	July 1.	43 2	29 1	27 2	41 3	41 9	
11.	48 6	32 2	28 0	33 9	40 0	34 0	8.	43 0	27 9	27 11	41 9	42 4	
18.	47 2	31 6	30 0	32 4	39 2	36 5	15.	43 3	29 10	28 4	40 6	41 3	
25.	47 4	30 10	20 8	31 6	38 6	36 0	22.	43 10	28 1	27 10	40 0	40 6	
Aug. 1.	48 4	31 6	20 6	32 4	36 6	35 0	29.	43 9	27 6	27 9	39 6	40 2	
8.	48 7	31 10	20 10	33 6	30 5	30 9	Aug. 5.	43 0	30 9	27 3	39 4	40 3	
15.	48 9	31 8	28 6	34 6	35 2	33 4	12.	41 8	28 11	26 3	41 2	41 8	
22.	48 9	33 6	24 6	34 0	33 9	34 10	19.	41 8	29 10	26 9	40 6	41 0	
29.	48 1	36 0	22 7	34 2	41 7	39 2	26.	41 5	32 1	27 5	38 6	39 0	
LIVERPOOL.							DUBLIN.						
Date.	Wheat.	Barley.	Oats.	Rye.	Pease.	Beans.	Date.	Wheat.	Barley.	Ber.	Oats.	Flour.	
								p. barl.	p. barl.	p. barl.	p. barl.	p. barl.	
	20 st.	16 st.	17 st.	14 st.	9 st.								
1863.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	1863.	s. d.	s. d.	s. d.	s. d.	s. d.	
June 6.	45 1	31 6	23 0	32 2	41 6	43 5	June 5.	28 6	16 4	15 1	14 0	19 6	
13.	45 2	30 9	24 1	31 6	39 6	40 9	12.	28 4	16 2	15 0	14 2	19 7	
20.	45 9	31 8	23 4	30 6	38 4	39 6	19.	28 6	16 3	14 10	14 0	19 8	
27.	44 9	32 1	21 8	31 4	38 8	39 0	26.	28 0	16 6	15 2	14 4	19 8	
July 4.	46 2	33 2	28 2	32 6	39 6	39 8	July 3.	28 2	16 4	15 1	14 2	19 9	
11.	44 5	33 6	31 7	32 8	42 0	42 4	10.	28 4	16 2	15 0	14 0	19 10	
18.	46 6	32 4	23 5	33 2	40 6	40 8	17.	28 4	16 2	15 0	14 5	19 9	
25.	46 7	31 6	22 1	32 4	38 6	39 2	24.	28 6	16 0	15 2	14 9	19 9	
Aug. 1.	44 2	31 8	21 10	31 9	36 6	36 1	31.	28 9	16 1	15 1	14 8	19 9	
8.	46 4	31 4	21 0	32 6	35 0	34 2	Aug. 7.	28 6	16 1	15 0	14 6	19 10	
15.	45 5	30 10	25 6	33 9	34 6	33 8	14.	28 1	15 10	14 9	14 4	19 10	
22.	46 1	32 2	20 8	34 0	33 8	34 10	21.	28 4	16 2	15 0	14 6	19 10	
29.	45 2	35 6	22 7	34 4	33 4	38 2	28.	28 0	16 6	14 2	14 0	19 9	

TABLE SHOWING THE WEEKLY AVERAGE PRICE OF GRAIN,

Made up in terms of 7th and 8th Geo. IV., c. 58, and 9th and 10th Vict., c. 22. On and after 1st February 1849, the Duty payable on FOREIGN CORN imported is 1s. per quarter, and on Flour or Meal 4½d. for every cwt.

Date.	Wheat.		Barley.		Oats.		Rye.		Pease.		Beans.	
	Weekly Average.	Aggregate Average.	Weekly Average.	Aggregate Average.	Weekly Average.	Aggregate Average.	Weekly Average.	Aggregate Average.	Weekly Average.	Aggregate Average.	Weekly Average.	Aggregate Average.
1863.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
June 6.	46 10	46 5	31 11	33 9	23 10	22 2	32 5	32 6	36 8	35 8	39 10	38 5
13.	46 11	46 8	32 4	33 5	22 10	22 6	34 10	34 5	36 11	35 11	39 8	38 6
20.	46 9	46 9	30 7	32 10	23 0	22 6	32 8	34 8	37 10	36 6	40 4	39 3
27.	46 5	46 8	31 2	32 8	22 10	22 9	35 9	35 0	36 2	36 7	39 8	39 6
July 4.	46 11	46 9	30 9	31 9	23 11	23 0	32 11	34 9	38 0	36 11	39 6	39 8
11.	46 10	46 9	30 10	31 8	23 6	23 2	34 5	33 9	39 0	37 5	40 2	39 10
18.	46 7	46 9	28 10	30 9	22 6	23 1	32 0	33 10	37 0	37 6	40 0	39 11
25.	45 11	46 7	29 10	30 4	22 9	23 1	32 8	33 6	35 11	37 4	39 8	39 10
Aug. 1.	45 11	46 5	31 0	30 5	23 0	23 1	37 11	34 5	36 3	37 1	39 11	39 9
8.	46 3	46 5	31 6	30 6	23 0	23 1	31 6	33 8	34 9	36 10	38 8	39 7
15.	45 11	46 8	31 4	30 7	23 1	23 1	36 4	34 3	35 7	36 5	40 7	39 9
22.	46 5	46 2	31 1	30 7	23 0	23 0	33 2	34 1	34 9	35 9	40 4	39 9
29.	45 9	46 0	33 10	31 5	22 8	23 0	33 9	34 3	35 9	35 6	39 6	39 8

FOREIGN MARKETS.—PER IMPERIAL QUARTER, FREE ON BOARD.

Date.	Markets.	Wheat.				Barley.				Oats.				Rye.				Pease.				Beans.			
		s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.
1863.																									
June ..	Danzig	26	6	32	0	16	6	21	6	12	6	16	0	20	0	24	0	26	0	31	6	27	0	31	6
July ..		25	6	31	6	15	6	21	0	12	0	15	6	19	6	23	6	25	0	30	0	25	6	31	0
August..		25	0	30	6	14	6	20	0	12	0	15	0	18	6	22	0	24	0	28	0	25	0	29	0
June ..	Hamburg	27	6	32	6	16	6	22	0	14	6	17	6	20	0	23	6	26	0	30	6	26	6	31	0
July ..		26	0	30	6	15	0	21	6	14	0	16	6	19	6	22	0	25	0	29	0	25	6	29	6
August..		25	6	30	0	15	0	21	0	13	6	15	6	18	6	21	6	24	6	28	6	25	0	29	0
June ..	Bremen	26	6	32	0	16	6	21	6	14	0	16	0	20	0	23	6	26	0	30	0	26	6	30	6
July ..		25	6	30	6	15	6	21	0	13	6	15	6	19	6	22	0	25	6	29	6	25	0	29	0
August..		25	0	30	0	15	0	20	0	12	6	14	0	18	6	21	6	25	0	28	6	24	0	28	0
June ..	Königsberg	28	0	33	0	15	6	21	6	14	0	18	6	20	0	25	0	26	0	32	0	27	0	33	0
July ..		27	0	32	6	15	0	21	0	13	6	18	0	19	6	24	0	25	0	30	6	26	0	31	0
August..		26	6	30	6	14	6	20	6	12	6	16	0	18	6	22	6	24	0	29	0	25	0	30	0

Freights from the Baltic, from 3s. 9d. to 5s.; from the Mediterranean, from 9s. to 12s.; and by steamer from Hamburg, from 4s. to 6s. per imperial qr.

THE REVENUE.—FROM 1ST APRIL 1862 TO 30TH JUNE 1863.

	Quarters ending June 30.		Increase.		Decrease.			Years ending June 30.		Increase.		Decrease.	
	1862.	1863.						1862.	1863.				
	£	£	£	£	£	£	£	£	£	£	£	£	£
Customs	5,791,000	5,857,000	66,000	..	..	..	23,644,000	24,100,000	456,000	..	..	..	..
Excise	4,886,000	4,405,000	..	..	481,000	..	18,047,000	16,674,000	..	..	1,373,000	..	..
Stamps	2,253,000	2,394,000	141,000	..	..	..	8,657,945	9,135,000	477,055	..	..	..	..
Taxes	1,357,000	1,390,000	33,000	..	..	..	3,154,000	3,184,000	30,000	..	..	..	..
Post-Office ..	850,000	950,000	100,000	..	..	..	3,535,000	3,750,000	215,000	..	..	..	..
Miscellaneous	500,904	576,204	75,300	..	..	..	2,098,844	3,128,861	1,030,017	..	..	..	..
Property-Tax	2,722,000	2,918,000	196,000	..	..	..	10,549,000	10,713,000	164,000	..	..	..	..
Total Income	18,359,904	18,490,204	611,300	481,000	..	..	69,685,789	70,684,861	2,372,072	1,373,000	..	..	..
Deduct decrease .....	..	..	481,000	..	..	..	..	..	..	1,373,000	..	..	..
Increase on the qr. ..	..	..	130,300	..	..	..	..	..	999,072	..	..	..	..

PRICES OF BUTCHER-MEAT.—PER STONE OF 14 POUNDS.

Date.	LONDON.				LIVERPOOL.				NEWCASTLE.				EDINBURGH.				GLASGOW.			
	Beef.	Mutton.	Beef.	Mutton.	Beef.	Mutton.	Beef.	Mutton.	Beef.	Mutton.	Beef.	Mutton.	Beef.	Mutton.	Beef.	Mutton.	Beef.	Mutton.	Beef.	Mutton.
1863.	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.
June ..	7 9	8 9	8 6	9 6	7 6	8 6	7 9	8 9	7 6	8 6	8 0	9 0	7 9	8 9	7 9	8 9	7 6	8 6	7 9	8 9
July ..	7 6	8 6	8 3	9 3	7 3	8 3	8 3	9 3	7 3	8 3	7 9	8 6	7 6	8 6	7 6	8 6	7 9	8 9	7 9	8 9
August.	7 9	8 9	8 6	9 6	7 6	8 6	8 0	9 3	7 9	8 9	8 0	9 3	8 0	9 0	8 0	9 3	8 0	9 0	8 0	9 6

PRICES OF ENGLISH AND SCOTCH WOOLS.—PER STONE OF 14 POUNDS.

ENGLISH.				SCOTCH.			
	s.	d.	s. d.		s.	d.	s. d.
Merino,	23	0	to 28	Leicester Hogg,	25	0	to 28
.. in grease,	18	0	.. 23	.. Ewe and Hogg,	21	6	.. 25
South-Down,	23	0	.. 30	Cheviot, white,	22	0	.. 25
Half-Bred,	18	0	.. 22	.. laid, washed,	16	6	.. 19
Leicester Hogg,	25	0	.. 28	.. unwashed,	12	6	.. 16
.. Ewe and Hogg,	21	0	.. 25	Moor, white,	11	0	.. 14
Locks,	12	0	.. 14	.. laid, washed,	10	0	.. 13
Moor,	9	0	.. 11	.. unwashed,	8	0	.. 9

ON THE EFFECTS OF EXTRA MANURING OF TURNIPS.

BY MR HENRY STEPHENS.

AFTER a period of much thought and many experiments, experience has enforced the conviction that only two of the light manures are really worth incurring trouble and expense in raising our crops—namely, Peruvian guano and phosphates, whether prepared from bones or minerals. Every other light manure seems only a modification of these two standard elements of artificial manuring. Until lately, these substances were applied in small quantities, not exceeding 2 or 3 cwt. to the imperial acre. At times they were used separately, at other times in combination with one another, or with farmyard dung. The most recent experiments have indicated their value in combination rather than singly. Still the mind is not satisfied that light manures have yet produced what they are capable of. Dissatisfaction on this ground has prompted many to use much larger quantities, and the results have been encouraging; but before resolving to use such manures to an inordinate degree, the consideration of cost naturally suggests a caution against eventually adopting even so laudable a resolution. Dreading the cost, and apprehending it might not be repaid by the increased produce, experiments have been confined by the caution of only expending a given sum per acre, not considering that crops have no regard to cost, but solely to the quantity and quality of the food allotted to their use. Some adventurous spirits have, however, not been constrained by the dread of cost. The quantities of the light manures have therefore been doubled, but the results have not been increased to a corresponding degree. It was forgotten that even a large increase of manure, even more than the double, may fail to stimulate the soil to remunerative action, and that until the point of rousing the soil to that activity is arrived at, no increase of manure will insure a remunerative increase of crop. As in the affairs of men, so in the life of plants, there is a tide which, taken at the flood, may produce results beyond the most sanguine expectations. That such a mode of reasoning as regards plants is supported by experience, the results of the following experiments will amply testify:—

The Carse of Gowrie with its strong clay soil is not the district one would resort to for successful turnip culture. It is a mistake, however, to suppose that the soil of the Carse is entirely composed of strong clay; there is also much deep black mould, and the strongest clay when deep drained becomes so modified in texture as to produce turnips of the most splendid description. On the farm of Nether Mains of Pitfour, in the Carse of Gowrie, occupied by Mr Thomas Hope, both sorts of soil exists, and, as might be expected

from the difference of their nature, they each best produce different crops. "My rotation," says Mr Hope, "on my stiff clay land, is a six-shift :—First, potatoes treated with 28 tons of farm-yard manure of the best quality per Scotch acre, ploughed into the land in winter, and 3 cwt. of Peruvian guano and dissolved bones sown by hand in spring, when the potatoes are planted ; Second, wheat ; Third, grass ; Fourth, oats, assisted with 3 or 4 cwt. of Peruvian guano and dissolved bones ; Fifth, turnips grown from 25 tons of dung ploughed-in in winter, and 6 cwt. of dissolved bones and Peruvian guano in spring, when the turnips are sown ; Sixth, wheat." It will be observed from this statement that the land receives in the course of six years 53 tons of farmyard manure, and 13 cwt. of Peruvian guano and dissolved bones, on the Scotch acre, a manuring much heavier, we suspect, than most of the land of this country receives. And is there a corresponding increase of crop from this manuring? Let us see. "From this treatment," says Mr Hope, "I generally receive about 34 tons of yellow turnips per Scotch acre. When I apply only two-thirds of the above manuring, the turnips cost me about 2s. per ton more money. Another consideration, when there is a full crop of say 34 tons, is the extra quantity of leaves, which I reckon worth 20s. per acre to the next crop. I find the land is much cleaner than after a crop of half that weight. I also hold that the crop derives a much greater advantage from the atmospheric influences, when 34 tons, instead of 20 tons, are obtained, because, as I conceive, the more extended surface of leaves takes in a larger quantity of ingredients from the atmosphere that are conducive to their growth."

Mr Hope never sows swedes upon the heavy clay land, because they are long in coming to maturity ; whereas the yellow turnip can be pulled and stowed in autumn, leaving the shaws on the ground, for wheat to be sown immediately thereafter. In 1861, Mr Hope sowed yellow turnips upon the clay land without any farmyard manure, and applied 10 cwt. of Peruvian guano and 10 cwt. of dissolved bones, per Scotch acre, and obtained a return of $44\frac{1}{2}$ tons per acre, rooted and shawed.

In 1861, Mr Hope raised Swedes on his deep black land, giving no farmyard dung, but 10 cwt. of Peruvian guano and 10 cwt. of dissolved bones, per Scotch acre, and obtained a produce of 52 tons per acre, rooted and shawed. When he gives half that quantity of guano and bones, the crop costs him from 1s. to 2s. per ton more money, and there is, besides, the want of the extra quantity of leaves to assist the succeeding crop.

In 1861, on the farm of Yestermains, one of the Marquess of Tweeddale's farms in his own hands, 20 cart loads of farmyard dung, with $2\frac{1}{2}$ cwt. of Peruvian guano, and $2\frac{1}{2}$ cwt. of phospho-Peruvian guano, per Scotch acre, gave a return of 44 tons 2 cwt. to the acre, rooted and shawed, of purple-top yellow turnips. It should

be held in remembrance that the year 1861 was a very favourable one for the growth of turnips. As an immediate and striking contrast between two seasons on the growth of turnips, we may mention that Mr George Bell sowed Skirving's improved swedes, in 1862, on rich loamy clay on his farm of South Inchmichael in the Carse of Gowrie, with 20 tons of farmyard dung, and 8 cwt. of Peruvian guano, and received a return of only 26 tons 15 cwt. per Scotch acre; 20 tons of farmyard dung, and 8 cwt. of superphosphate, produced 25 tons 5 cwt. And, contrary to expectation, 20 tons of farmyard dung, and 20 cwt. of a mixture of Peruvian guano and superphosphate, in equal parts, only gave a return of 23 tons 5 cwt., rooted and shawed in every case. Had the same experiments been made in 1861, who can doubt that the results would have approached those which were obtained by Mr Hope and at Yester? The difference must, therefore, be ascribed to the climate of the two seasons. Mr Bell's explanation is, "the subsequent wet weather proved very unfavourable for the full development of the plants, especially of those in the lots which received the greatest quantities of manures, as they continued growing to the shaws, when those having less manure made more to the bulbs, which accounts for those producing more weight per acre."

In the present favourable season for turnips of 1863, 45 tons of greystone white turnips were raised at Yestermains, with $3\frac{1}{4}$ cwt. of Peruvian guano, and $3\frac{1}{4}$ cwt. of phospho-Peruvian guano, per imperial acre, without the assistance of farm dung. "The land received a good coating of lime-compost in the autumn of 1860, on young grass; was grazed in 1861, and bore a crop of oats in 1862. It was then ploughed 14 inches deep; the turnip drills were made on the stubble furrow, and the turnips sown in the latter end of May 1863."

It may be useful to make an estimate of the pecuniary value of these great crops of turnips, with the cost of raising them, in order to ascertain whether or not it is the interest of the farmer to run the risk of spending money on large quantities of manure, such as large crops may be supposed to require. Were seasons always of an average quality, it would doubtless be prudent on the part of the farmer to aim at obtaining the largest returns, but in two such opposite seasons as 1861 and 1862, the results obtained by Mr Bell hold out little encouragement to the timid farmer; while, on the contrary, they may act as a positive deterrent. However, let us ascertain how the results of those two seasons actually stand. We should premise, that in calculating the value of turnips in relation to the product of the manures, it will not do, as is usually done, to divide the weight of the turnip by the cost of the manure, because, incongruous materials should not be contrasted, such as weight with cost, but congruous ones, such as weight with weight, and value with cost. The money value of the product ought first to be

ascertained, and then the money value of the manures deducted therefrom, and the result will give the true money value of the produce. If it is desired to estimate the absolute produce per ton, the produce of an unmanured portion should first be ascertained and deducted from the gross weight of the manured portion, and the number of tons from each portion will then be known, and may be compared.

The money value of the manures may be set down at the following rates:—Farmyard dung at 6s. per ton; Peruvian guano, £13;* superphosphate, £8; phospho-Peruvian guano, £11, 9s.; dissolved bones, £8. The value of the respective kinds of turnips may be taken at 15s. per ton for swedes, 10s. for yellow, and 5s. for white.

In the good year of 1861, the value of Mr Hope's yellow turnips should be thus:—

44½ tons of yellow turnips, per Scotch acre, at 10s. per ton,	£22	5	0
Raised from 10 cwt. of Peruvian guano, at £13 per ton,	£6	10	0
And 10 cwt. of dissolved bones at £8 per ton,	4	0	0
			<hr/>
			10 10 0
			<hr/>
			£11 15 0

The surplus sum of £11, 15s., at 10s. per ton, gives 23½ tons profit per acre of yellow turnips in regard to the efficacy of the manures employed, but irrespective of the cost of cultivation.

The value of Mr Hope's swedes in 1861 should be thus:—

52 tons of swedes, per Scotch acre, at 15s. per ton,	£39	0	0
Raised from 10 cwt. Peruvian guano, at £13 per ton,	£6	10	0
And 10 cwt. dissolved bones, at £8 per ton,	4	0	0
			<hr/>
			10 10 0
			<hr/>
			£28 10 0

The surplus sum of £28, 10s., at 15s. per ton, gives 38 tons per acre of swedes of profit in regard to the efficacy of the manures employed, but irrespective of the cost of cultivation.

The value of the Marquess of Tweeddale's yellow turnips in 1861, should be thus:—

44 tons 2 cwt. per Scotch acre of purple-top yellow turnips, at 10s. per ton,	£22	1	0
Raised from 20 tons per acre of farm dung, at 6s. per ton,	£6	0	0
2½ cwt. of Peruvian guano, at £13 per ton,	1	12	6
And 2½ cwt. of phospho-Peruvian guano, at £11, 9s. per ton,	1	9	6
			<hr/>
			9 2 0
			<hr/>
			£12 19 0

* At present Peruvian guano is advertised at £12 per ton, but when the experiments were made it was £13.

The surplus sum of £12, 19s., at 10s. per ton, gives nearly 26 tons per acre of turnips as profit in regard to the efficacy of the manures employed, but irrespective of the cost of cultivation.

In the bad year of 1862, the value of Mr Bell's swedes should be thus:—

26 tons 15 cwt. per Scotch acre of Skirving's improved swedes, at 15s. per ton,	£20	1	3
Raised from 20 tons per acre of farm dung, at 6s. per ton,	£6	0	0
And 8 cwt. of Peruvian guano, at £13 per ton,	5	4	0
	<hr/>		
	£8	17	3

The surplus sum of £8, 17s. 3d., at 15s. per ton, gives 11 tons 16 cwt. of swedes per acre as profit in regard to the efficacy of the manures employed, but irrespective of the cost of cultivation.

25 tons 5 cwt. per Scotch acre of swedes, at 15s. per ton,	£18	18	7
Raised from 20 tons per acre, farm dung, at 6s per ton,	£6	0	0
And 8 cwt of superphosphate, at £8 per ton,	3	4	0
	<hr/>		
	£9	14	7

The surplus sum of £9, 14s. 7d., at 15s. per ton, gives nearly 13 tons per acre of swedes as profit in regard to the efficacy of the manures employed, but irrespective of the cost of cultivation.

23 tons 5 cwt. per Scotch acre of swedes, at 15s. per ton,	£17	8	7
Raised from 20 tons per acre of farm dung, at 6s. per ton,	£6	0	0
10 cwt. Peruvian guano, at £13 per ton,	6	10	0
And 10 cwt. of superphosphate, at £8 per ton,	4	0	0
	<hr/>		
	£0	18	7

The small surplus sum of 18s. 7d., at 15s. per ton, only gives 1 ton 4 cwt. per acre of swedes as profit in regard to the efficacy of the manures employed, but irrespective of the cost of cultivation. Upon the whole, a loss was incurred by this experiment, if the cost of cultivation is included.

In the favourable year for turnips, 1863, the value of the Marquess of Tweeddale's white greystone turnips should be thus:—

45 tons per imperial acre of white greystone turnips, at 5s. per ton,	£11	5	0
Raised from 3½ cwt. Peruvian guano, at £13 per ton,	£2	2	3
And 3½ cwt. phospho-Peruvian guano, at £11, 9s. per ton,	2	0	8
	<hr/>		
	£7	2	1

The surplus sum of £7, 2s. 1d., at 5s. per ton, gives 28 tons 8 cwt. per acre of white turnips as profit in regard to the efficacy of the manures employed, but irrespective of the cost of cultivation.

From these authenticated facts, we are warranted in deducing a few conclusions.

1. It is quite obvious that climate has a predominating influence upon the growth of turnips. In the favourable year of 1861, Mr Hope obtained no less a weight than 52 tons per Scotch acre of swedes, from 10 cwt. of Peruvian guano and 10 cwt. of dissolved bones per acre; whereas, in the bad year of 1862, Mr Bell could obtain no more than 23 tons 5 cwt. per Scotch acre of swedes, from 10 cwt. Peruvian guano and 10 cwt. superphosphate per acre, aided by the addition of 20 tons per acre of farm dung. Mr Bell's crop was thus 125 per cent less than Mr Hope's, with even 25 per cent more of manure. The soil employed by Mr Bell is represented as a "rich loamy clay," and that by Mr Hope, "deep black land," the two being situate only a few miles asunder in the fertile district of the Carse of Gowrie. On account of the seasons, the management would be somewhat different of the two crops, the seed having been a fortnight too late of being sown at Inchmichael, and the crop was otherwise not handled as it would have been in a favourable year. Allowing for the injurious effects of these untoward circumstances, mere difference of treatment is not sufficient to account for the great disparity in the yield of the two crops, which must, in fact, be ascribed chiefly to the different states of the two seasons.

2. Another conclusion is, that even in an unfavourable year, extra manuring may procure, or even insure, a profit from the turnip crop. In the bad year of 1862, Mr Bell obtained 25 tons 5 cwt. per Scotch acre of swedes, from 20 tons of farm dung per acre, and 8 cwt. of superphosphate, and realised a profit of £8, 18s., 7d. per acre of turnips beyond the cost of manure. And even in the smallest return of 23 tons 5 cwt. of swedes, he incurred no loss as far as the large quantity and cost of manures were concerned. In the smallest case, the "braird was dilatory, but the leaves soon became growthy and uncommonly dark in colour, and continued to grow until it was too late for the bulbs to attain a proper size."

3. A third conclusion is, that although a mixture of manures is favourable towards developing the turnip plant, it is not so in every case. A good result from mixture of manures was obtained by Mr Hope in 1861, the good year, by employing 10 cwt. of Peruvian guano, and 10 cwt. of dissolved bones per Scotch acre, and obtaining 44½ tons of yellow turnips; and in the same year 20 tons of farm dung per Scotch acre, with 2½ cwt. of Peruvian guano, and 2½ cwt. of phospho-Peruvian guano, procured to the Marquess of Tweeddale 44 tons 2 cwt. of purple-top yellow turnips. On the other hand, in the bad year of 1862, Mr Bell obtained a profit from swedes of £8, 18s. 7d. per Scotch acre, from using a single ingredient of 8 cwt. of superphosphate; whereas, in the same year, from swedes also, in employing a mixture of as much as 10 cwt. of Peruvian guano and 10 cwt. of superphosphate, his profit was reduced as low as 18s. 7d.

per acre. Farmyard dung, in like quantity, was used in both cases, but may be left out of consideration in instituting this comparison, just as equivalents are eliminated in reducing algebraic formulæ. When alluding to equivalents and mixtures, we may mention that Mr Bell procured the same weight of swedes of 19 tons 5 cwt. per Scotch acre, in using 20 tons of farm dung, as with a mixture of 5 cwt. of Peruvian guano and superphosphate; and it is also worth mentioning that, on increasing the mixture to 10 cwt. per Scotch acre, the swedes were increased to 22 tons 10 cwt., the extra value of the manures to £2, 11s. 11d., being covered by the increased value of the swedes to £4, 5s.—a profit not to be despised, small as it is, in an unfavourable season, and evincing the vital efficacy of manures, even under adverse circumstances. A rather satisfactory result from a small mixture of manures was obtained in the rather unfavourable year of 1860 at Yestermains: 8 cwt. of Peruvian guano produced 27 tons 2 cwt. of purple-top yellow turnips; while a mixture of Peruvian guano and phospho-Peruvian guano of only $4\frac{1}{2}$ cwt., produced 26 tons of the same turnips: 15 cartloads of farm dung having been applied in addition in each case.

4. An important lesson may be learned from another legitimate conclusion, that the effects of deep cultivation of land upon turnips may be equal, if not superior, to those of manuring. In 1861, Mr Hope obtained $44\frac{1}{2}$ tons per Scotch acre of yellow turnips from 10 cwt. of Peruvian guano, and 10 cwt. of dissolved bones. In 1863, the Marquess of Tweeddale obtained 45 tons per imperial acre of white greystone turnip, from $3\frac{1}{4}$ cwt. of Peruvian guano, and $3\frac{1}{4}$ cwt. of phospho-Peruvian guano. The apparent results of these cases are, that $6\frac{1}{2}$ cwt. of Peruvian guano and phospho-guano procured a weight of turnips equal to 20 cwt. of Peruvian guano and dissolved bones. The difference between the cases is, that Mr Hope's results were derived from the Scotch, while the Marquess's were from the imperial acre. Elevating the imperial to the Scotch measures, it appears that 8 cwt. of Peruvian and phospho-Peruvian guano produced 54 tons of turnips, whereas it required 20 cwt. of Peruvian guano and dissolved bones to produce $44\frac{1}{2}$ tons. Still there is a material difference between the two results. The 54 tons obtained at Yestermains were from the white greystone turnip, whereas the $44\frac{1}{2}$ tons produced at Pitfour were yellow turnips. Of course yellow turnips are more nutritive than white, but if we allow for the additional 10 tons of the white, we may, perhaps, arrive at the conclusion, that no great disparity now exists betwixt the productive powers of the Pitfour and Yestermains soils as regards turnips. While meditating on these similar products, an important question arises in the mind, of—What was the normal condition of these soils? The answer to the question involves a mode of cultivation, to adopt or reject which depends, in our opinion, the future welfare of the farmer. To give the answer in a satisfactory manner, it is necessary to enter

into a few details. Mr Hope's farm is, perhaps, not 100 feet above the sea-level. Its soils consist of rich loamy clay and black land of great depth, capable of bearing every species of crop. The climate of the Carse of Gowrie is good, the soil having a southern exposure, protected from the north by high grounds, and stagnation of the air above it is prevented by the ebb and flow of the tidal wave from the estuary of the Tay. The rent of such land is £5 or £6 the Scotch acre. The Yester farms are 450 feet above the sea. They lie on the northern base of the Lammermuir Hills. The soil in its normal state was a thin mould resting upon an inferior clay of different hues. Its natural vegetation was worthless. The rent did not exceed 10s. the Scotch acre. The change effected by cultivation upon this soil is almost beyond credibility. By draining with tiles, and by a system of deep culture through the means of a plough, followed in the same furrow by a particular form of subsoiler, each propelled by four horses, the soil and subsoil have been stirred and mixed together permanently to the depth of 22 inches. This species of culture, we are sorry to say, is yet peculiar to Yester. The soil thus treated is capable of raising every kind of farm crop. On comparing the above results, it is demonstrated that this poor soil of a few years ago, is now not behind the richest soil of the country for raising turnips plentifully and economically. It has not yet, and perhaps never will, equal the Carse land in bearing a large crop of fine wheat. The yield of wheat in the Carse is generally 6 quarters, it is often 8, and in this fine season of 1863 it may be considerably more. In 1812, we know that the farm of Seaside, in the Carse, raised 8 quarters of wheat over 100 acres of land, at £6 a quarter. And yet the Yester wheat has obtained the top price in the Haddington market. The depressing climate of 1862 reduced the return of wheat in the Carse to $2\frac{1}{2}$ quarters per Scotch acre, and of course imposed upon it an inferior quality. So the cereal crops were as much affected in the Carse last year by the climate as were the green crops.

5. From this particular comparison of such opposite original states of soil, we may venture to conclude that by deep culture every piece of very poor land may be brought up to the level of the naturally richest, in producing crops large in quantity and fine in quality. It may now be assumed as a fact, in regard to cultivation of the soil, that until the plough and subsoiler shall have gone before and removed from our rough soils the stones and the boulders they contain, the steam-plough will not have a chance in Scotland of executing the deep cultivation of the soil, and deep culture we must now have whether by means of animate or inanimate power. With the deep stirring of the soil previously accomplished, there will be no difficulty in one pair of horses turning over the oat stubble in autumn to the depth of fourteen inches, the soil lying in a broken and pulverised state all winter, and waiting in a clean condition for the spring, when

it will be found ready, upon the stubble furrow, to be dunged and drilled for any green crop. The spring work would thus be expedited at almost the command of the farmer, without the aid of grubbers and crushing rollers as pulverisers.

Before concluding, we may adduce an instance of a large crop of turnips being produced without extra manuring, and, indeed, without manure at all, in the ordinary acceptation of the word, and at a time before light manures were heard of. A heavy crop of turnips, and even of swedes, is not a recent achievement. When the late Mr Joseph Tod had the farm of Whitelaw, in Berwickshire, he took the grass parks within the policy of Wedderburn, for a term of years, to cultivate them and lay them down again to grass. One of the grass parks, of forty imperial acres, came by course of cropping in 1815 for turnips, after a heavy crop of oats in 1814 from old grass. The stubble was well ploughed in the autumn of 1814, and as the winter of 1814 and spring of 1815 experienced severe frost, the stubble land became finely pulverised. Mr Tod was advised to take a second crop of oats, and no doubt it would have proved a success; but as the taking a second white crop involved a dereliction from the ordinary mode of farming, he determined on sowing swedes without manure of any kind. Having a finely pulverised surface, he was unwilling to disturb it by a spring furrow, and drilled it up for turnips in the early part of May. The seed was sown with a turnip machine—common in those days—the handles of which were movable, and by their action elevated the coulter over any turfy clod that may have come in its way. The summer season having been most favourable for the growth of every kind of crop, the swedes grew apace, and by October had attained to a splendid condition. At that time we walked over the field of forty acres, and did not find a single turnip less than the size of a man's head, and as close together in the drill as they could grow. Not having spare stock of his own at Whitelaw, Mr Tod let the swedes at Wedderburn to be eaten by cattle and sheep. One half of the crop was pulled off for the cattle in the hammels, and the other half left on the ground for sheep. The cattle were to pay 5s. a head per week for turnips, accommodation, and straw; and aged sheep—for swedes were not considered suited to hogs—at 6d. a head per week.

On stripping the turnips for the cattle, they were not weighed; but it was said they realised £50 per acre by the end of the feeding season in May. If this be true, and taking the price of swedes at the time at 20s. per ton, the yield was 50 tons per imperial acre; and at 15s., it would be 66 tons 13 cwt. While the turnips were being pulled, a noticeable phenomenon presented itself. No manure being used, the turnips depended for support entirely upon the decaying turf of the grass-land. The previous crop of oats had reduced the tenacity of the old turf very considerably. As the turnips were pulled, it was observed that most of them adhered by their roots

very strongly to the decaying turf. White fibrous roots interlaced themselves like a net-work through the substance of the turfs, which were with difficulty removed from the bulbs. The same thing may be seen when turnips are pulled in a dry season, with the dry farm dung adhering to them. The summer of 1815 was warm, sunny, and dry; but occasional showers dropped their genial influence upon all the crops; so that we do not remember any season, before or since, in which every kind of produce have attained their maturity to such perfection. We may indicate something not commonly believed from this phenomenon. Those who maintain that plants can only subsist upon food in a state of solution, would be puzzled to account, in the warm and dry season of 1815, how the very large crop of swedes attained its great weight and perfection in that season, upon the decaying turf of what had been a grass field. Such a phenomenon induces to the belief that plants may take their food, under certain circumstances, in a different state than that of absolute solution in water. What may be the exact mode of action of the spongeoles of plants, when they extract their nourishment from food in a dry state, we may never be permitted to know; but that certain sorts of plants, and particularly the cultivated ones, do derive support from manure in a dry state is beyond question.

From all that has been stated above, we think we are warranted in believing, that extra manuring will procure a very heavy crop of turnips in a good year, and an ordinary one in the most unfavourable season. As an encouragement to others, we may mention that Mr Hope is of the opinion, from his own experience, that he can grow turnips cheaper per ton when applying 16 cwt. per Scotch acre of dissolved bones and guano mixed, than when half that quantity is used.

WILLIAM HARLEY AND HIS DAIRY SYSTEM.

So far as we can find, but very scant justice has been done in agricultural works to the memory of the man who was the first in this country to supply, on a large scale, our city populations with that most healthful, most nutritious, and most indispensable of household necessities, pure fresh Milk. Of course it may be argued, in justification of the neglect, that the practice of fifty years ago, however excellent then, is of no value now, and that an account of the Willow Bank Dairy would be of no practical advantage to the dairyman of the present day. But this mode of reasoning would be equally effective against the publication of any narrative of the voyage of Columbus for the discovery of the Amercian continent, because our sailors do not now follow the ocean track of the great Genoese. Our own opinion is, that the world should be chary of forgetting its pioneers in any branch of invention, discovery, or industry. However small the improvement the invention effects, however meagre the discovery, or slight the advance in industrial science, we may rest assured it is worth while ever and again to recognise these and the men to whom they were due ; and not merely as evincing our gratitude, but because such recognition tends to stimulate men living to emulate and excel their predecessors, and so, independently of the pleasant feeling which gratefulness brings, we may reap substantial benefit as well. For, as in this land,

“Freedom broadens slowly down,
From precedent to precedent ;”

so does progress in the arts and sciences “creep from point to point ;” and it is essential to the knowledge of the advance we have made to turn back now and then to look at the points we have left.

In some such spirit, and to some such end, is it, that we wish to recal, briefly, the life and labours of a man who, as we have said, seems to have been strangely neglected by other agricultural authors.

William Harley was a man of no small note in his day. He was honoured by the patronage of not a few noblemen in the land, who appear to have been actuated less by the feeling of proud condescension, which the position of patrons usually implies, than by a real belief in the excellent and deserving nature of Harley's work. His dedication to the volume in which he gives an account of his dairy system is of so singularly comprehensive a character, and so free from the customary sycophancy of dedications of the time, that it is worth while to quote it here. It is as follows :—

“To her Grace the Duchess of Leeds ; the Members of both Houses of the British Parliament ; and other Noblemen and Gentlemen, the author's patrons. May it please your Grace, my Lords and Gentlemen :—To you, and especially to that exalted patroness who has conferred upon me most

distinguished marks of kindness and condescension, I respectfully dedicate the following pages, illustrative of an attempt (I hope I may call it a successful one) to benefit the public. The imperfect system of dairy husbandry which had long prevailed, suggested to me the conviction that important improvements were attainable in this valuable branch of rural economy. To accomplish these in a manner that should render them worthy of universal imitation, required no inconsiderable capital, much practical knowledge, and incessant personal attention. Such, at least, were the desiderata impressed upon me in the progressive formation of, and long before I had ultimately succeeded in perfecting the Willow Bank dairy—an undertaking which the citizens of Glasgow, and many of you, my Lords and Gentlemen, in the visits with which I was honoured, have been pleased to speak of in terms that it would ill become me to repeat, but the flattering kindness of which is associated with my happiest recollections. As senators, ever alive to the protection which British agriculture in all its useful varieties claims from you in your legislative capacity, I submit the history of my humble labours to your impartial review; and as subscribers and patrons, I am proud in the opportunity thus offered me of testifying the readiness with which you are respectively known to encourage the exertions of individuals who disseminate their knowledge with a view to public utility."

There is a genuineness about this utterance one cannot help liking. It is the true expression of the sentiments of an honest man, and not vulgar flattery.

Harley was a native of Perthshire, having been born amid the Ochils, at a place called Glendovan. He was left an orphan at an early age, but he had excellent up-bringing from his grandmother, who was a woman of good intelligence, sound common-sense and kindness of heart, combined with great firmness. As indicative of the latter trait in the character of the Lady of Whiteridge (for by such name was she known, her income being derived from a property called Whiteridge), it is mentioned that, on one occasion, during the Rebellion of 1745, the Pretender sent to claim feu-duty for the land which she held from the crown, the alternative of refusal being the reiving of the cattle on the land; but the "Lady" having previous warning of this friendly visit, transported all the animals to a distant locality, and then, on their arrival, peremptorily refused to pay the duty. She had the sagacity, however, to entertain the tax-gatherers liberally, and also to furnish them all on their departure with a "whang of bread and cheese," or other palatable commodity, which so delighted the not over-well-fed followers of the Prince that she was never more molested.

While Harley was yet a youth, how old we know not exactly, for in his brief memoir he does not condescend upon the date of his birth, he removed to Kinross to learn with a maternal uncle the art of weaving sattinets. Such an occupation was sadly against the grain at first, for the young gentleman was proud withal, and had a very low idea of the social standard of a weaver. Indeed he had so poor an opinion of the respectability of a man who gained his living by working the treddles and throwing the shuttle, or by employing others to do it for him, "that he considered the distinction to be but a shade

between a weaver and 'a finisher of the law.'” However, at Kinross he soon got over that unworthy prejudice, and seems to have applied himself to the business with zeal and assiduity. From Kinross, where he learned to make fine linen, he proceeded to Perth to acquire a knowledge of the manufacture of brown linen, and from thence he was transplanted to a manufacturing establishment in Glasgow in 1789. Applying himself to business here as keenly as he had done elsewhere, he obtained sufficient acquaintance with the cotton manufacture to enable him to commence business on his own account in 1790.

In 1794 Mr Harley introduced a new article of manufacture—viz., that of Turkey-red checked gingham—a species of goods which, up to this time, were unknown in our country. During the first season he manufactured this commodity exclusively for an Edinburgh merchant; but it became so popular in a short time, that London took large quantities of it, and it was also largely exported to the West Indies. In 1802 Mr Harley purchased a few acres of ground, for the purpose of erecting a family residence thereon, at Sauchy Hall. Here he found a plentiful supply of fine fresh water, of which Glasgow (for then Loch Katrine was undreamed of as a reservoir to furnish water for the toddy of St Mungo's citizens) was very much in want. With the spirit of a philanthropist, as well as the shrewdness of a man of business—two qualities which were combined in Harley in a remarkable degree—he had carts and four-wheeled carriages constructed to carry the water daily from his property for sale at a small but remunerative price in the city. The success of this scheme paved the way for the formation of a Water Company, when, of course, the Willow Bank water was unneeded. Harley, however, did not let it run to waste. Hot and cold baths seemed to be a desiderata in Glasgow, and these he immediately erected. The success was very considerable—a good many invalids especially taking advantage of them. Glasgow was not then the overgrown city it now is, and Sauchy Hall, instead of being almost in the centre of the town, may be said to have been wellnigh in the heart of the country. At all events, it was so far away from shops that a wish was expressed by the visitants to the baths to have a drink of milk as a refresher after their long walk. Harley, in compliance, sent a cow to be milked at the baths, and this was the foundation of his great dairy, which attracted the attention of even the kings and princes of Europe. Not to break the narrative of this brief memoir, however, we shall delay the notice of the dairy until we mention the few other leading facts in the life of its originator. Harley's next act for the public good was the formation of a market-garden at Blythswood, with which he supplied the city with fresh vegetables, fruit, &c. A portion of the land was laid out in arbours and bowling-greens, with tasteful walks, &c., and here the Glasgovegians came out to enjoy them—

selves on fine summer afternoons. Harley, by the purchase of the lands of Enoch Bank, next opened up St Vincent Street, George Street, Renfrew Street, Bath Street, and Nile Street, and afterwards, by building upon them, may be said to have originated the New Town. Nile Street was founded upon arches, and Harley, who put everything to use, converted these into ice-houses.

The baking trade in Glasgow was at that time carried on by people whose practices were not always of the most honest kind. Harley was pressed to become a baker on a large scale by many of the most respectable of his fellow-citizens. He at first refused, but after being continuously importuned for about two years, he finally consented. The same success attended his operations here as in his other avocations. His bread was greatly superior to that of all others, and, as a consequence, he received large custom, not only in the city, but in every district on the coast where the bread could be obtained.

Harley did not confine himself to the promotion of the physical comfort of his townsmen; he also exerted himself to secure the moral welfare of the young. At the time he went to Glasgow the citizens had each in their turn to do nightly the duties of policemen, these useful functionaries not being then an institution of our land. "In the author's turn," says Harley, "to perform that duty, it constantly occurred to him to be a witness of such deplorable scenes of vice and depravity, as to impress upon him the conviction that, if some feasible plan were devised, and followed up with resolution of purpose, much of this dissoluteness might be reclaimed. With a view to obtain this desirable end, and with the co-operation of others in advice and assistance, a number of Sabbath-schools were opened in the city and neighbourhood for imparting religious instruction to the children of the poor, the author's clerk keeping an account of the number of schools, scholars in each, &c."

From the dens of the city, Harley, by kind entreaties, promises of little presents, &c., persuaded the young Arabs, and Arabs of an older growth, to enter his schools, and, in the course of two years, about 400 children and adults, who at the time they were picked off the street did not even know the alphabet, had been taught to read the Bible.

One is inclined to wonder how so much in such a variety of undertakings could be accomplished by one man. Harley himself gives an explanation. "If it be asked how a single individual could project and properly conduct so many different concerns, it is answered, that it was not from any vain opinion of the competency of his own abilities, but in a judicious division of *time* and *labour*, and in the uniform adoption into every department of that comprehensive word *system*—these may be said to have been the regulating powers of his extensive machinery. The motto, in short, throughout his establishments was, 'Every man at his post and doing his duty.'"

With the peace succeeding the battle of Waterloo came a reverse in Harley's fortunes, which he describes as paralysing his exertions, and as having "produced a revolution in his operations which formed a source of deep regret on many accounts, but especially as regarded the throwing out of employment so many necessitous workmen and faithful servants (some of whom had been with him nearly twenty years), and the compulsion that was imposed upon the author to discontinue his contributions to several institutions which he had assisted to establish."

Harley appears afterwards to have gone to London to establish a bread manufactory similar to that he had set a-going in Glasgow, and he was in London at the date of writing his preface, in 1829. At that time it was in contemplation to erect, under his management, a small dairy after the Willow Bank pattern as a model. We cannot find, from the cyclopædias of biography, which often busy themselves with people to whom the world is much less indebted, anything of the after-life of this man, who, coming as a stranger into Glasgow, left it so permanently benefited and improved.

When, in 1809, Harley founded his dairy, Glasgow was very badly supplied with milk. It was selling at eightpence per Scotch pint, which was exactly four times the price it had been a quarter of a century before. The supply was deficient even at this then high price; what was still worse, the quality was execrable, both on account of the bad management of the dairies and the practice of adulteration almost universally resorted to by the dealers; and, besides being cheated in the quality, the public were also swindled in the quantity of the milk. There was no standard measure, and the buyers were obliged to be satisfied with what the dealers chose to give. "As an instance to what extent the want of system was carried, and the random manner in which the dairy business was conducted, each dealer had measures suited to his own peculiar views—that is, they were either very small or middle-sized, according to the measure of his own conscience; and it not unfrequently happened that when, in the winter season, the quantity was diminished, instead of getting new measures of a still smaller size, the sides of the summer measures were beaten in to reduce their dimensions, thus adapting the quantity they should hold to a winter price."

Harley commenced the business of dairyman, after finding his one cow's milk at the bath taking so well, by building a dairy capable of containing twenty-four cows. All the dairies then—as indeed they are too often still—were in dark, dirty, close localities; and the cowhouses themselves were ill-lighted, badly-ventilated, and, in general, very far from cleanly. Indeed, cleanliness was almost impossible under the circumstances. Harley selected for the site of his experimental dairy a fine, airy situation, at the head of Nile Street; and he showed equal sagacity in securing plenty of light and venti-

lation. The cows were arranged in double rows, face to face, as in the best dairies of the present day, with a passage between for supplying the food without disturbing the cattle. The praise of the milk from this dairy was soon in everybody's mouth. No wonder; for, besides being vastly superior to that they had been in the habit of receiving, it was twopence per pint less—being sold at sixpence instead of eightpence—and the measure was honest. The success of the dairy was such as to render an immediate extension necessary. This was immediately set about, a building for the accommodation of a hundred cows being erected. This was the dairy which excited the admiration of all who beheld it, and the fame of which was so noised abroad, that it became one of the "lions" of the time, and a much more useful lion, too, than such "public beasts" usually are. The site was the same as that occupied by the old dairy, which indeed was made to form part of the new. Being on an inclined plane, the building was reared upon groined arches, divided into three apartments by transverse walls. In the centre division was received the dung from the dairy, whence it was easily carted away. Another division was fitted up for cows that were dry and prepared for fattening; for Harley sold off all his cows that had ceased to yield him so much milk as they ought to do in a fat state to the butchers. "This apartment, being quiet, and having little light, was deemed better adapted for carrying on the process of fattening than the other cowhouses, darkness and quiet greatly contributing to assist the progress, and make the cattle much sooner fit for slaughter." The third division was appropriated as a cellar for holding provender for the cattle, and, being well ventilated, answered the purpose remarkably well. Thus the inequality of the ground, which many would have deemed a great disadvantage, was actually turned to profitable account. The proprietor also further took advantage of the situation on the incline, to run down the urine of the cows into a large tank, fifty feet long, six wide, and six deep. Nothing was allowed to go to waste at Willow Bank.

The main building, which contained, as we have mentioned, one hundred cows, was ninety-four feet in length by sixty-three in width inside the walls. Its height was nine feet, and it was covered with three roofs, in a pavilion form, the central one being twenty-four feet wide, and the others nineteen and a half feet each.

"These roofs rested upon two longitudinal beams supported by cast-iron pillars. There were no horizontal ceilings; the slates were hung to the rafters on pins, and were not lime-pointed, but had a good cover. This mode saved a considerable expense, ventilated the house better, and was found warm enough for cattle in the coldest weather. There were thirty windows in the roof, each three feet six inches by one foot eight inches, hung with hooks and eyes, and having a latch-handle fastened to the bottom of the frame, inside, to admit atmospheric air at pleasure, and promote ventilation. There were four windows in each side of the roofs, and one at each end. In warm weather part of the doors and windows were opened, and

when very hot, the whole were opened wide, which produced a free circulation of cool air. In short, by attending to a proper ventilation of the grand cowhouse, and preserving at the same time an equal temperature, the cattle, whether for milking or fattening, were uniformly in good health, and in the finest condition. The heat was generally kept at the temperature of from 60 to 64 degrees Fahr.; and as the walls were plastered carefully, the cattle never experienced any injury from cold even in winter. It was often necessary, however, even at that season, to open some of the windows on the lee side of the house; and if more air was wanted, it was found better to open one or more windows on the windward side than to open any door. It was customary, also, especially in cold weather, before opening the doors at the end of the feeding passages, to shut all the windows, as a direct current of cold air suddenly admitted was found to be exceedingly injurious. Great care was also taken to have all the doors and windows tight, and not to admit cold air but when necessary. There were, in all, eleven doors in the cowhouse—viz., one at each end of the five longitudinal passages, measuring seven feet by three feet six inches; and one at the end of the wide passage, seven feet by six. All the passages were laid with the hardest hewn free-stone; the five longitudinal ones were each five feet wide, commencing at the side walls; the transverse passage was nine feet wide near the centre of the building, there being four rows of twelve cows each on one side, and four rows of thirteen cows each on the other. The passages were rounded two and a half inches across, which made them wear much longer, and if any liquid was spilt it ran off."

The floor on which the cows stood was raised about six inches above the passages. The front part of the stalls was composed of composition, in order that the knees of the cows might be injured as little as possible when lying down; the middle portion was flagged with hewn stone; and the part nearest the passages, about eighteen inches from the groove for the urine, was of stripped ashlar work, and with an inclination sufficient to allow the fluid to run off, the cows being thus always kept dry. The stalls were about nine feet six inches in length, and six feet four inches in breadth, and were made to contain two cows each. They were fastened by chains, in much the same fashion as in the best cowhouses of the present day, but this sensible mode of tying up animals was at the time very uncommon. The common method, and it was a barbarous one, not yet out of fashion in some districts of Scotland, was to fix the animal's neck between two stakes, so that it stood very much like a culprit in the pillory. We notice from a recent French agricultural periodical, that this practice prevails on a newly-erected Model Farm in one of the French departments. Mr Harley thus comments, and with truth, upon this old plan:—"This, to say the least of it, is exceedingly improper, for it completely prevents what is at once a natural and very necessary operation of the animal itself—viz., the licking of its skin; whereas, by the mode of fastening by a chain and swivel, the cows can at all times apply their tongue to any part of the body as easily as if they were in the fields. . . . The author," he continues, "is persuaded that it is of importance to indulge the cows in their propensity to lick with the tongue, as it contributes, like currying, to create a free perspiration, and to increase the circu-

lation of the blood ; it also tends greatly to promote the general health of the animal." The arrangements for preserving the manure were good, in so far that they admitted of perfect cleanliness being preserved in the cowhouse ; and, being "preserved from wind and weather, it was considered worth from 25 to 50 per cent more than dung exposed to the atmosphere. It sold at from 5s. to 8s. per ton ; the cow-water sold at from 4s. to 6s. per butt of about 400 gallons. According to the best calculation, the manure of each cow was worth, upon an average, about £5 per annum."

The Willow Bank cowhouse, as we have mentioned, soon attracted, from the novelty of its plan, and the perfection of the system, a large amount of public attention. In fact, it drew such a number of visitors as to seriously inconvenience the servants, and annoy the cows by disturbing them. This the proprietor was loth to allow, but he was equally loth to turn visitors away. His ever-ready brain was not long in devising a method by which his establishment could be seen, and yet neither servants nor animals be troubled. The plan was certainly a curious one. He gave "directions for erecting a balcony in the new cowhouse, from which a *bird's-eye view of the whole interior of the cowhouse and its hundred cows could be obtained at one glance* [the italics are Harley's own], without producing the slightest annoyance or inconvenience either to the servants or cattle. In constructing this improvement the proprietor was induced, for various reasons, to study effect ; the chief object, however, was to gratify the numerous spectators, whose frequent visits had now become highly excited. The balcony was therefore erected on the outside of the building, opposite to the main passage ; it was about four feet above the level of the floor, and open in front to the cowhouse, where a large curtain was suspended. Visitors, on their arrival, were requested to insert their names and place of residence in an album kept for that purpose. The keeper then, by means of a pulley, drew aside the curtain, when the whole establishment, with its hundred cows and their attendants, were instantly presented to the view of the delighted and astonished spectators. Princes, noblemen, and gentlemen, from almost every quarter of the globe, bore testimony to this interesting panorama. All, indeed, were charmed with the order and arrangement observed in the plan, and uniformly lauded it as unrivalled both in execution and design. After the balcony had been erected, the Harleian cowhouse became, as it were, one of the 'lions' of the day. In fact to visit it occasionally became the fashion of the town ; and the author, to gratify the desire that prevailed, had copperplate tickets of admission engraved, with a design symbolical of a woman milking a cow, and groups of children drinking milk, under the Glasgow Arms. These tickets were adapted for the admission of any number from one to six. The admission was fixed at one shilling each, which actually pro-

duced about £200 per annum." Here, again, we see the business, money-making habit of Harley cropping out. Besides the people who had to pay for admission, and which, at the high charge of a shilling each, would reach 4000, there were a large number, friends of the proprietor and his friends' friends, admitted to the cow-exhibition free.

The same excellent judgment which arranged the cowhouse was also displayed in the formation of the milkhouse. To the east of the cowhouse there was a deep ravine, with a small stream flowing through it. This was arched over; and one of the arches, 45 feet long, 12 wide, and 12 high, from the floor to the centre of the arch, was formed into the milkhouse, the side-walls being 6 feet high. The entrance was from the north; and a large window in the south end, covered with a fine wirecloth, afforded light; while five circular openings in the centre arch, also covered with wirecloth, served to admit light and air. The side-walls and roof were lathed and plastered, 6 inches being left between the stone-work and the plaster for the free circulation of air behind the plaster, and openings, covered with wirecloth, were placed at intervals to admit of the air playing through the whole building. The floor was of polished ashlar, and had an inclination, from the entrance to the extremity, sufficient to admit a flow of water through it into a cesspool beneath. At the north end was a pipe, by which water in the rivulet, over which the milkhouse was built, could be turned into the room. The milk-dishes were placed on the pavement along both sides of the building, and were usually filled with milk to the depth of three or four inches. When the vessels were filled with milk, the cesspool at the south end was plugged up, and the water at the north end let on, until it sufficiently covered the floor where the milk-dishes stood. "This cooled the house; and the fixed air, or the spring of the water, carried up the steam of the milk through the circular openings in the top of the arch." When the dairymaid went to cream the milk, the cesspool was opened, and the water allowed to run off. The place was kept scrupulously clean, the floor, besides being constantly flooded in the way mentioned, being regularly washed and rubbed with a dry cloth. This, with the free ventilation of air through the premises, insured that the atmosphere was always pure and sweet. In order to make the circulation of air more effectual, a tunnel, about a foot square, was conveyed under the street along the top of the arch, and two transverse tunnels crossed and communicated with the central one in the middle of the house—that is, they were carried from the sunk area on the south to the north side of the building. There were strong wire-gratings put at the mouth of these tunnels to prevent vermin getting in. It was not necessary, however, to devise any plan for keeping out flies from the milkhouse, as it was remarked whenever they got in by accident they did not

survive, owing to the coldness and rarefaction of the place. Modern dairy-keepers have yet a great deal to learn in the way of cleanliness and ventilation from old Harley.

Mr Harley had a steam-engine for churning, thrashing, slicing turnips and potatoes; and, even so early in the history of agricultural implements for the economising of food, he had a chaff-cutter and a corn-bruise. The servants' duties were very methodically arranged; indeed, but for his thorough systematicalness, Harley could never have managed half the things he undertook. At half-past four in the morning the watchman who was stationed on the premises all night, and who examined the cows in the byre every half-hour to see that nothing was going wrong, rang the bell for the servants, who assembled at five. The byremen, or cowfeeders, having lighted the gas, for by such means was the establishment lighted, proceeded to tidy up the cows' bedding, and *clawt* the dung into the groove. This done, all hands assisted in carrying in the mash or soft provender for the cows, the byremen giving the dry provender. The milkers, chiefly women, each of whom had from twelve to fifteen cows to milk, proceeded to their work. Each was furnished with a milking-pail, a large tin vessel for receiving the milk of the whole lot, and a towel and stool. Every two milkers had a pail between them for washing their hands and the cows' udders, which they took charge of on alternate days. A mop was also provided them for washing the floor. At eleven o'clock the byremen gathered up the clean straw which had been laid down in the morning; the milkers, having assisted in giving the soft food, then cleaned and curried their respective lots of cattle. Then dry food was given, and the beds relaid by the byremen, and the place was shut up until three, when the operations of feeding and milking, as in the morning, were repeated, and the place was once more shut until seven P.M. At that hour the litter was once more gathered up, the water let off, and all hands assisted in giving water and pot ale, or a mixture of these, to the cows. Afterwards a full feed of dry provender was given them, the dung was taken away, the place cleaned, and the cows' beds relaid. The house was then shut up about eight o'clock for the night. "The provender commonly used at Willow Bank consisted of hay, straw, grass, and green barley, Swedish turnips, and the different varieties of Aberdeen yellow, red tops, &c., also mangold-wurzel, carrots, cabbages, ground oil-cake, bruised beans, and other grains."

The milking-pitchers were of black oak, with a white stave for a handle, upon which there was a graduated scale in black scores and figures, by which it was at once seen how much each cow gave. The clerk, or those who carried the milk into the office, had running numbers of the cows placed upon a slate, and opposite to these numbers the quantity of milk, as shown on the graduated scale, obtained

from each cow was set down, and was afterwards transferred into the milk-book.

"To insure the cows being completely milked, the milker of No. 1 stripped No. 2, and a small premium was given weekly to the milker who produced the greatest quantity from stripping, which induced carefulness in milking. . . . The milkers changed their respective lots of cows with each other weekly, and by rotation, which showed which were the best milkers. Each milker's name was entered at the top of the list of their own lot of cows, and in this way the alternate weekly change was effected without mistake or irregularity. The aggregate quantity of milk yielded by all the cows on the measuring day (which occurred once a-week) should correspond with that of the other six days. When the quantities did not tally, the measuring of each individual cow's milk indicated whence the disproportion arose, and to which animals the fault attached; it also assisted in judging which ought to be selected for sale."

It was found that there was often a striking difference in the returns from various cows, and it was also generally observed that the quality decreased with the quantity, and *vice versa*. Some cows just after calving gave as much as even 30 quarts per day, while some were dry, or nearly so; but on the average there were obtained every day at Willow Bank 1200 quarts of milk, or about 12 quarts from each of the cows, taking them overhead. It was observed that both the quantity and the quality of the milk was affected by the different kinds of food that were given. "Potatoes, distillers' grains and wash produced the greatest quantity of milk, but the quality was thin and poor; on the other hand, green clover, rye-grass, clover-hay, yellow and Swedish turnips, bean-meal, oil-cake, &c., produced rich milk and a fair-yield."

At the milk-office, about seven o'clock in the morning, and in the afternoon, there was always a very animated scene. Here the distributors were in waiting to receive the milk to start on their various rounds. Each distributor had a pair of milk-pitchers, with lids to fit tight, which contained from 12 to 18 quarts. These were locked to prevent adulteration. This was found necessary on account of dishonest servants, influenced by small dealers, sometimes extracting a portion of milk and filling the vessels up with water. To find out a plan that should effectually prevent such robbery gave Harley more trouble, he says, than all the other departments of the establishment. He was ultimately successful, however, in devising a plan "which completely answered the purpose. There were three small tin tubes put betwixt the handle of the lid of the milk-vessel and the lid itself. These afforded additional strength to the handle, and prevented it from bending when another pitcher was placed upon the top of it, which was often the case when the milk was drawn off. The two side tubes were soldered to the lid and the under side of the handle; the centre tube was put down through the lid, and was soldered close round, and the upper end of the same tube was also soldered

to the under side of the handle, except a small point about one-sixteenth of an inch, which was left open. This admitted a sufficient quantity of air through the tube to allow the milk to run off, and at the same time it effectually prevented the admission of water. Previous to this simple discovery, the author [Harley] applied to many to learn if they were acquainted with, or used any plan for checking the adulteration in question, but it was admitted by all that they had never been able to devise any scheme that would prevent their servants from putting water into the milk, if they were so inclined, as the hole on the top of the milk barrel or vessel, from which a pin was taken to admit the air, always suggested the facility of introducing water." Besides the pitchers referred to, the distributors also carried, as retail measures, a Scotch pint or quart, and the sixth or twelfth of a pint, the full of these being sold at sixpence, threepence, one penny, and a halfpenny respectively. The milk-carriages were all hung upon springs to prevent shaking as much as possible, and they were drawn through the city by ponies. "The vessels were labelled 'New Milk,' 'Skimmed Milk,' &c., in order that the customers might be sure of the quality of the article which they purchased. Each distributor was provided with a bell to warn the customers, and if any unreasonable detention occurred, the customer was given up. Punctuality, in short, was so strictly observed, that each customer knew, within a few minutes, the precise time when the milk would arrive." Each distributor had his own route, and all the routes were so arranged that they could all finish about the same time, and a fine was imposed for every quarter of an hour a distributor was behind the fixed hour in returning. A distributor trusting a chance customer was made responsible for the debt, and it was deducted from his wages on the first pay-day.

The novelty of this dairy scheme, the superior quality of the milk, the cleanliness which characterised the distributors, and the admirable manner in which the establishment was conducted, naturally caused a great demand for milk; and whenever it got into a district, it was noticed that the smaller dealers immediately began to sell milk of better quality, and in more honest measures than they had previously been in the habit of doing.

"And after all, notwithstanding the gloomy anticipations entertained by them and their friends, not even the small dealers had any reason to complain of the result; for, as the Willow Bank business increased, so did theirs; and in the course of a very short time it was computed that the number of cows kept for dairy purposes in Glasgow had doubled. At the end of about six years from its commencement, there were in the Willow Bank dairy alone 260 cows, which, it is presumed, was a number equal to that which had been previously kept by the whole of the small dealers, and yet their business had never sustained the least decline. The liberal supply furnished from Willow Bank induced a laudable emulation among the small dealers, and hence arose all the advantages which the citizens so decidedly experienced. The least of these, perhaps, were the improved quality of the milk, and the reduction of the price. The sale of milk now became an extensive and regular

object of trade ; and in a commercial town the success and extension of one concern naturally benefit every other. *Harley's Milk* also became the fashion. Its unrivalled excellence was the subject of every lady's praise, so that many who had never thought of it before, now became consumers of milk as a part of their daily food."

Harley's dairy attracted the attention of the Highland Society, which appointed a deputation to inspect and report upon it. The report was so favourable, that the Society presented Harley with a piece of plate bearing the following inscription:—

"Voted by the Highland Society of Scotland to William Harley, Esq., Glasgow, for having constructed a dairy establishment upon a new and extensive plan at Willow Bank, in the vicinity of that city, which was ascertained, upon inspection and report by a Committee of the Society, to possess important advantages. 1814."

We trust this brief and imperfect sketch of a man who gave such a stimulus to dairy husbandry, and who was undoubtedly a great public benefactor, may not be deemed uninteresting by our readers ; and we are inclined to think that there is that in his system which, though originated upwards of half a century ago, might be copied with advantage by many dairymen of the present day.

THE STORING OF ROOT CROPS.

WHEN the last waggon-load of sheaves has disappeared within the capacious doors of an English barn, and when the Scotch farmer can say that all his crop is safe under "thack and rape," the labours of the year are seemingly looked upon as finished ; and it is customary to celebrate the event by the joyous "harvest home" of "Merry England," and the "rantin' kirk" of "the Land o' Cakes." It is meet and right that this should be the case ; that after all the toils and anxieties of the year,— •

"harvest labours
Richly crowned, should bind all neighbours
In a thankful harvest home."

We have little sympathy with those who would churlishly refuse at such a season to countenance harmless mirth on the part of those who have toiled to fill their barns, and whose daily experience is one of unceasing drudgery. That such an expression of joyous feeling should ever degenerate into wanton riot is to be deplored ; but in this, as in many other instances, we are firmly convinced, from a long experience of the labouring population of our rural districts, that they are often "more sinned against than sinning." There is no doubt a deal of mawkish sentimentalism

afloat with respect to what is called "the condition of farm-labourers," and with many this subject is always a safe card to play when something in the way of sensation is wanted; nevertheless it is unquestionably true that the very temporary nature of the connection between master and servant in modern times has tended to do away with those feelings of mutual regard which existed between employers and employed in the days of our fathers—feelings which often led masters to share in the joys and sorrows of their dependents, as if all were members of one family, instead of the great gulf which modern habits have placed between the different parties. Under present circumstances, therefore, a harvest home may degenerate into a scene of wild revelry, simply from the want of such a restraining influence as that which would be exercised were employers to evince a more hearty personal interest than they frequently do in their people—not treating them as a set of wild animals let loose for a night, but as rational men and women assembled to enjoy a little amusement in a rational manner. And if masters and their families might with the greatest propriety join their servants in celebrating the annual "harvest home," even clergymen would by no means be out of their place on such occasions. We are glad to find this feeling is gaining ground, especially in England; and what a grave, pious, and learned Bishop of Oxford has done, men of less note surely may do, without lessening the dignity of their position.

But although custom—descended from the time when corn was the only produce of the tilled fields—has sanctioned the practice of holding the harvest home when the grain has been finally secured, there still remains, in modern farming, a considerable proportion of the crops yet unsecured. This proportion may amount to a fourth, a fifth, or a sixth, according to the course of cropping followed; but in all cases it is of sufficient importance to claim a large share of attention. The British farmer of the present day can no more get on without his root crops, than a steam-engine can get on without coal and water. They set the entire system in motion; and their occurrence, at stated intervals, keeps it going.

Potatoes claim attention, in the first place, in what we may call the second harvest.

From the unaccountable obstinacy with which English farmers have resisted any attempt to collect accurate agricultural statistics, we are, of course, unable to form anything like a correct idea of the extent which is devoted to the growth of potatoes in that part of the kingdom. They occupy, however, a considerable proportion of the fallow-crops in Yorkshire and some other counties, the London market being their principal ultimate destination. Thanks to red-tapeism, which strangled the invaluable co-operation of Mr Hall Maxwell and his able staff of

practical "enumerators," we have had no returns of Scotch cropping since 1857; but in that year 139,819 acres were devoted in Scotland to the cultivation of the potato, the estimated produce amounting to 430,468 tons; the proportion which the crop bore to other crops in the rotation being about 4 per cent. It is right to state, however, that the foregoing average did not represent the entire amount actually under potatoes in Scotland in 1857, because there were no returns from occupants whose rent was below £20, in the counties of Argyle, Arran, Inverness, Zetland, Ross, and Sutherland, and these counties are the strongholds of small farmers, who are everywhere the largest growers of potatoes in proportion to their other crops. The Irish statistics have told us every year, for the last sixteen years, how the crops stand in the western division of the British Islands; and the last return, that for 1863, states that out of 5,661,179 acres under all kinds of crops, including "meadow and clover," no less than 1,023,626 acres were devoted to potatoes—that is, nearly one-fifth of all the crops grown last year in Ireland. These facts show the importance of the potato crop, and the propriety of attending carefully to every point by means of which its produce may be increased, and its preservation secured.

Previous to the appearance of what is designated, *par excellence*, "the disease," potatoes were often stored anywhere, in cellars or in "pits," without much regard to the effect which the manner of storage might have on the tubers. Indeed, potatoes were usually looked upon at that time as something which possessed such an inherent degree of hardiness, that they might be tossed, tumbled, and put past for the winter in any place which might be most convenient without injury; and we have not the slightest doubt but that all this carelessness had its due effect in weakening the vegetative powers of the tubers, bringing on "curl," and other tokens of declining strength, which afterwards culminated in that "disease" with which we are now but too familiar.

The general potato-harvest commences as soon as the corn crops have been all secured, and it is essential that dry weather shall be selected for the work. The crop is sometimes dug out by men who use broad-toed forks for this purpose; but digging is slow and expensive work, at least when the crop is grown in drills, and the plough is generally preferred. Some use the common plough with the coulter removed, and, when the soil is free, the potatoes may be gathered without much trouble; but we consider the "brander" a great improvement, as it serves to shake the potatoes out from among the earth, leaving them quite exposed for those who follow and gather the tubers. Hanson's Digger is also a most effective implement, as it does not leave a single potato covered, and at the same time it does not injure

them, notwithstanding its powerful mode of action. The 'Book of Farm Implements' gives the following description of the Potato-digger :—

"The essential parts of the machine consist of a flat broad share and revolving forks. The share is attached by a stem, capable of adjustment to the framing ; this share goes under the potatoes, effectually breaking up and pulverising the soil, and freeing the potatoes from the drill. In close contact with the upper surface of the share a series of two-pronged forks revolves. These forks, eight in number, project from the periphery of a disc, which receives motion from the driving-wheels of the machine. The shaft of the digger-disc is placed transversely to the length of the share. As the tendency of the revolving forks is to throw up or scatter the potatoes to a considerable distance laterally, a strong netting is attached to the side opposite to that at which the stem of the share is fixed. The potatoes, as they are thrown up, are arrested by this netting, and are laid along the drills in regular rows."

The existence of disease in the potato renders it absolutely necessary that the tubers, when gathered, shall be carefully examined previous to being finally stored up ; and while this examination is going on, the tubers may be sorted into proper sizes. Before this examination was required, it was customary to "size" the potatoes by means of wire riddles, which allowed all the small tubers, say those under an inch and a half in diameter, to pass through. If the crop is perfectly sound, and the tubers about to be sent to market immediately, or very soon after they are lifted, the riddles answer well for sorting ; but we do not like them when the tubers are intended to be stored for some months, because we have found that riddle-sorted potatoes are sometimes apt to get discoloured when kept over until spring—that is, little black spots appear under the skin, which disfigures them very much when brought to table. When potatoes are intended, therefore, to be kept over, it is safer either to hand-pick the different sizes at the same time when the diseased tubers are taken out, or merely to pick out those which show tokens of disease, leaving the "sizing" until the store is opened, and the potatoes are wanted either for use or for sale.

We have tried several plans of storing potatoes, and we believe that, unless on a small scale, there is no way in which they keep better than in "pits," with some modifications of the old system. The plan we ultimately decided upon as the best in our experience was, to lay down a row of drain-tiles along the line of the intended heap, and as the heap was made up, we put a chimney, also of tiles, or pipes, at about every four yards. When tiles were used as chimneys, two were set on end, with the lower part meeting together so as to form a pipe, and those tiles or pipes rested on bricks, which raised them above the level of the ground, and secured a constant passage of air into them from the under line of tiles. These chimneys were carried up until they rose above the top of

the heap when it was finally finished. The heap should not be wider at the base than four feet, and the potatoes are built up in a triangular heap on that base to the height of about two and a half feet. Some make their heaps larger, but it is safer to increase the size in point of length than in that of thickness or height. The heaps must be made on a piece of dry ground, the potatoes covered with a good coating of dry straw, and then with earth taken from a trench formed on each side of the heap, so that the heap, although called a "pit," ultimately stands on a raised platform which secures it from wet, particularly when a trench is dug at the lowest point to carry away any rain or snow-water which might accumulate about the heap. The coating of earth must be sufficiently thick to keep out frost, and the whole is finished in the same triangular shape that the potatoes were piled up. The heat which takes place in the heap is carried off by means of the chimneys; and these chimneys should be stuffed with straw every evening in case of frost, the stuffing being removed in the morning, and after a time, when the potatoes have ceased to heat, the chimneys may remain closed. There is nothing new in all this; we know it was practised by some people before there was any appearance of "disease;" but it is the plan which has succeeded best with us since the disease has become known. We have pitted potatoes in a mixture of hot lime and earth, and they turned out very well; we have also mixed dry earth with them and made them up in heaps, and the result has sometimes been satisfactory, and sometimes the reverse. We have seen potatoes stored for the winter, when the disease was most virulent, along the side of a dry-stone wall, facing the north, having the wall on one side and hurdles on the other, both thickly lined with drawn straw, and then well covered above; in this state the potatoes kept well enough, but we found some years afterwards that the person who had tried it gave it up in favour of the old system of pitting, with this difference, that he made his potato heaps much smaller, that is, as to breadth of base and height, than he did previous to the appearance of the disease. When potatoes are stored on a small scale for family use, they may be kept very well in an outhouse, when mixed with plenty of dry earth. In this case, the tubers retain a good deal of the flavour belonging to newly-dug potatoes; but it is essential that the earth be perfectly dry—sand, light dry loam, or dry peat earth being the best—otherwise the tubers will decay, especially if any tendency to disease is lurking in them. The tubers must be turned over early in spring, in order to have the shoots picked off, as this mode of keeping excites vegetation, particularly when the house in which they are stored is warm, and perhaps not well ventilated.

When potatoes are diseased, it sometimes becomes a difficult matter to know what to do with them. In some parts of the

country mills were erected after the appearance of the potato disease, where the affected tubers were converted into starch; but we find that many of these have been given up, chiefly from the improved condition of the potato crops during late years. We observe that a correspondent of the 'Irish Farmer's Gazette' states that he has been in the habit of steaming or boiling his diseased potatoes, and then pounding and packing them closely in a barrel, with salt intermixed with each layer of potatoes. The barrel is made air-tight, and he says that "the stuff cuts out like cheese, and all animals eat it well."

While the practice of storing the turnip crop is pretty generally followed in some parts of the country, there are many districts where it appears unknown. There is, however, much loss attendant on leaving the crop in the fields, arising from damage done to it by game, by frost, and in spring by the plants throwing up the seed-stem. When the bulbs are broken by game, they soon begin to decay, and frost also changes the nature of the plant, and renders it less nutritious. When the plants "start" in spring, the woody fibre of the bulb increases, and takes the place of matter which would have been of advantage to the animals fed on the bulbs; and every one knows that when the daily or weekly supply of turnips must be drawn from the field just when required, heavy snow-storms or hard frosts will often prevent them getting at the crop, and other food must be provided for the stock, leading occasionally to unnecessary expense and even actual loss. The poaching of the land by carting in wet weather is also a serious matter, and, for these reasons, we have long been strongly in favour of storing the turnip crop whenever its growth is at an end, except in the case of turnips which were being consumed by sheep netted on the crop; and even in that case, as the season advanced, we have followed out the principle of storing, although not in the same manner as in the case of that part of the crop which was destined for the use of cattle. We cannot, indeed, press the importance of storing the turnip crop in proper time, too strongly on the notice of those by whom it has not as yet been adopted. Some store, but they are too late in doing it, and, for that reason, they do not escape loss. Others, again, seem quite careless about the matter, and allow the turnip crop, upon the cultivation of which they spent both money and trouble, to "take its chance," as they say, of the weather; and in this manner the ultimate fate of the crop, and the short supply of "keep" they have for their stock, forcibly illustrates the truth of the old proverb, that "wilful waste makes woeful want."

Dry weather is as necessary for the ingathering of the turnip harvest as it is for that of grain—for turnips ought never to be stored while in a wet state. The crop will be ready by November, and every effort should be made during favourable weather to get

the bulk of the crop secured during that month. If the soil is light and dry—that is, land which will not be injured by carting, even in wet weather—a portion of the crop may be left in the fields, observing, however, that the daily supply required by the cattle shall be taken from the portion so left, reserving the stored part of the crop for future use. At the same time, we have preferred storing all the crop intended for cattle, even in the case of dry soils, unless prevented by some unforeseen circumstances; and we consider that, in the majority of cases, it is better to do so.

Turnips, when raised for storing, are trimmed to a certain extent; that is to say, the tops are cut off not less than about three-quarters of an inch above the bulb, and any earth adhering to the roots is cleared away, but the greatest care must be taken not to injure the bulbs, for they will decay rapidly if wounded. Careless people are very apt to slice off a considerable part of the top of the bulb, and some have a fashion of sticking the implement with which they cut off the tops—usually part of an old reaping-hook—into the turnips, either to pull the turnips out of the ground, or save themselves some little exertion. All this must be prevented, for every wound of the kind is destruction to the bulbs. It is advisable to cart the turnips from the field to the place where they are piled up and stored, as fast as they are prepared by the field-workers; but if this cannot be done, the bulbs should be thrown together in small heaps in the field, and covered up at night with the tops. It will be observed that it is only the tops which are removed when the turnips are being prepared for storing, the “tails” or roots are left untouched. Mr M'Lagan, Pumpherston, has recommended an improvement in the old sickle for the purpose of topping turnips. He says, in an excellent letter to Sir J. D. H. Elphinstone, Bart., which is prefixed to Duthie's Prize Essay on Storing Turnips, that “a better implement for topping and tailing is a knife with a broad piece of iron welded on at the point, perpendicular to the blade, whose edge is in the opposite direction to that of the piece of iron. The implement resembles very much a small hoe, if we suppose the blade of the knife to be the shaft of the hoe, and the piece of iron the iron part. The use of the piece of iron is to assist the worker to raise the turnip, when he could not do it by pulling the shaw alone.”

As we have been in the habit of covering the turnip-heaps with straw, the place selected for storing the bulbs has been either a piece of dry grass-land, or, what is better, a hard-paved or gravelled yard. We have sometimes covered the heaps wholly or partially with earth when straw has been scarce, and in that case the heaps were usually made in a part of the field where the crop was grown, and as near the gate as possible; but we prefer a dry yard, and straw as the covering.

The heaps are made of a triangular form—that is, from the base

to the apex—and the length of the heap must be regulated by circumstances. The base of the heap varies from 5 feet to 8 feet, and the sloping sides are built up regularly, the bulbs being thrown more loosely into the centre of the heap, until the apex is reached. If the sides are made too straight, the heap will be apt to burst, and the same will also take place if they are made too flat, or with too great an angle. The heap is covered 6 or 8 inches deep, with dry straw, which is secured by means of straw ropes. It is recommended by Mr M'Lagan to put a covering of wet straw over the dry covering as a further security against frost—the principal thing we desire to guard against in storing roots. We have not any experience of the use of wet straw, having found turnips to keep perfectly safe with such a covering as that which has been mentioned; at the same time, we do not mean to say that an outer covering of wet straw will not be found useful.

When turnip-heaps are merely covered with straw, there is no necessity for ventilating the heaps; but attention to this point is requisite when the heaps are covered, either wholly or in part, with earth. A slight covering of straw is advisable, even when the outer covering is earth, as the bulbs are thereby kept in a cleaner state, and are also better preserved from the effects of frost than they are when earth alone is used. In some districts ferns are to be got in sufficient quantity to afford plenty of material for covering both potato and turnip heaps; and dried rushes—which, we regret to say, still abound in some places—may also be made available for the same purpose, particularly as straw is likely to be a scarce article where either ferns or rushes abound. The ventilation necessary for turnip-heaps covered with earth consists in leaving the top uncovered for a time, except with a light covering of straw or material of a similar nature; but after “sweating” has ceased in the heap, earth may be put on the top, so as to finish the covering for the winter.

As it is not advisable that turnips should be allowed to sprout in the heaps, the roots must be turned in spring whenever it is observed that sprouting has commenced, when the young shoots will be broken off, and fresh heaps formed. By attending to this, and the other points we have mentioned, we have kept Swedes quite fresh and good until the cattle were going out of the yards in May upon their pastures for the summer.

All root-heaps should run north and south, by which the bulbs are not only less liable to be injured by frost, but the tendency to sprout is better checked than it is when one side of the heap faces the sun, as it would do if it was made with the ends pointing east and west.

Some people store large quantities of turnips, often in a wet state, in outhouses; but such a practice is most objectionable, as roots stored in that manner are exceedingly apt to heat and decay.

Root-houses, for containing a supply for immediate use, are essential in every steading; but we have never found it advisable to store above what would suffice for a fortnight in those houses. Root-houses should be sufficiently roomy to afford convenience for preparing the food for the use of the stock, by cutting or pulping.

Turnips are sometimes kept for the winter by being stored, on a piece of dry grass-land, in oblong heaps, about three feet in height and eight or nine in width. The turnips are merely covered with straw thrown on loosely, and we know that this plan is preferred by some extensive growers of turnips to the triangular heaps. In those instances of this mode of storing which have come under our notice, we have sometimes found the bulbs in good condition in spring, while in others we found more decayed bulbs than we think there would have been if the triangular form of heap had been adopted, with a fair covering of thatch.

Another plan, occasionally practised, is to store the turnips in small conical heaps in the following manner:—A circle is formed by arranging the bulbs with the leaves outwards, the latter not being removed as in other cases, and on this first circular row another is built so as to lessen the diameter, and thus the construction of the heap goes on, row after row, until the apex is finished with a single turnip set upright. It will be observed that the centre of a heap formed in this manner is hollow, and, next, that no thatch is required, because the leaves which are left on the turnips answer instead of thatch. This plan suits very well when turnips are to be stored in the field for the use of sheep, consuming them on the ground; but when intended for the use of cattle, the bulbs must be brought out of the fields, from these conical heaps, in the course of the spring, and made up into triangular heaps. This plan also expedites the work when, as it sometimes happens, there is a good opportunity for getting the turnips lifted, but when it is perhaps inconvenient to cart them at that particular time to the place where they are to be finally stored. Storing in this manner will therefore preserve them until such time as it is convenient to get them out of the field.

“Placing,” as it is termed, is an old way of storing turnips, and consists in taking the bulbs, with the leaves and roots untouched, and placing them upright in closely-set rows, on a piece of dry grass-land. The leaves form a covering, and in this manner the bulbs keep very well for a considerable time. It is only suitable, however, for small farms, where the breadth of turnips grown does not perhaps exceed four or five acres.

Where the turnip crop is consumed by sheep folded on it, the usual practice is to take away a portion of the crop for the use of the cattle fed at the steading, leaving one-third or one-half, or

two-thirds of the crop for the use of the sheep. This is done by taking away two drills of turnips, and leaving the next two, and so on, over the field—that is, when half of the crop is left. Some people even yet will not be at the trouble to cut turnips for their sheep, and feed them out of troughs, but allow them to eat the bulbs as they stand in the ground. This is poor economy, and the better plan is to prepare the food for the sheep. If the sheep are only allowed to use the turnips as they stand, and no other provision made, it will happen that during hard frost or deep snow the sheep cannot get at the turnips, and they will go back in condition. To prevent such a contingency, it is better to store the roots beforehand for the sheep; and this may be done either by means of the small hollow conical heaps we have referred to, or by pulling the bulbs in each pair of drills left together, throwing these bulbs in a close line, and then covering them up with a double turn of the plough. This will keep the bulbs fresh, and a supply available for the use of the sheep, except, perhaps, in cases of very severe frost, where the covering of earth will be found frozen as hard as stone. In such cases the sheep ought to be removed to a grass field, and supplied with food from the cattle stores of turnips.

Mangolds are not extensively grown in Scotland, although their cultivation might be extended in some districts where the soil and climate are suitable for them. We have seen some good crops in Ayrshire, and roots kept quite fresh until the new crop was nearly ready for being pulled. Mangolds form a considerable proportion of the green crop break in England and Ireland, the climate in those parts of the kingdom being more suitable for the profitable cultivation of mangolds than it is, generally speaking, in Scotland, and its cultivation both in England and Ireland is annually increasing. It is a valuable description of food for spring use, but it ought not to be given to stock in a fresh state, as it causes scouring in that condition, and the roots require to ripen in the heap before being used. We may remark here, that the bulbs grown on the farm resemble such garden fruits as the apple and pear. Some kinds are ready for use as soon as their growth is perfected, while others require to be stored, in order to allow time for certain chemical changes taking place in their juices, &c., by means of which they are rendered better adapted for use.

Mangolds may be stored in the triangular heaps which we have described when alluding to the storage of turnips, and in their case a good coat of thatch, well secured by straw ropes, is better than a coating of earth. The mangold heaps must also be turned in spring, and all the sprouts carefully picked off; and if the tendency to vegetation, which all roots exhibit, is checked in this manner, mangolds can be kept sound for a long time.

There is one point to be observed in preparing mangolds for

storing, in which they differ from turnips—namely, that the tops must not be cut off. The leaves are pulled or stripped off, but the crown or stalk must not be touched with a sharp instrument, as the least “bleeding” is destructive to the mangold. Dry weather is absolutely necessary when the bulbs are lifted, and it should always be done, if possible, before frost. At the same time, although the mangold is very susceptible of injury from frost, the bulbs are greatly preserved by the leaves which fall down over them and form a covering. For this, as well as other reasons, the practice of stripping off the leaves during autumn, which is practised by some people, ought not to be followed; and the leaves should be left untouched until the day when the bulbs are lifted and stored. Any roots which have been lifted and stripped, but not removed from the field, must be carefully covered up, to preserve them in case of frost during the night.

Mr Morton gives the following details of the manner in which he stored the mangolds and other root crops grown on Whitefield farm:—

“Two rows of hurdles are placed upon a firm piece of ground, parallel to one another, and 9 feet apart. The interval between these is filled with roots, the carts bringing them from the field being backed between them and tilted up at the proper place. The roots are piled up above the hurdles in a ridged or roof-like form, and are afterwards covered with straw, roughly drawn out as thatch, which is kept in its place by the weight of long poles resting upon it. At intervals of 2 or 3 yards faggots are placed in the centre of the heap, inclining backwards, and reaching from the ground to the roof. These act somewhat as chimneys, and facilitate a due ventilation of the heaps, thus hindering any tendency to heating or putrefaction in the roots.

“When one heap is completed, another is built within a foot of it, the passage left being intended both for the egress of the water which drops from the thatch and for the circulation of air. No security against frost at the sides of contiguous heaps is required further than that which is afforded by the interlocking of the bushy eaves of their respective roofs. When, however, a series of heaps has thus accumulated, a rough dead-wood hedge should be constructed around them, and the space between it and the hurdles, which may be 12 or 18 inches, should be loosely filled with straw.

“I have annually kept many hundred tons of swedes, carrots, and mangold-wurzels in this way, without losing any considerable portion by putrefaction. It fulfils the three conditions of success in the preservation of root crops through the winter; it furnishes security from the frost and wet, and at the same time provides sufficient ventilation of the heaps.”

Carrots and parsnips may also be stored in narrow triangular heaps, the outside rows being formed by the roots being laid, as in the case of other roots, with the crowns on the outside. These heaps need not exceed 3 feet in breadth at the base. Carrots and parsnips may also be kept in larger heaps, or in sheds, when mixed with a considerable quantity of dry sand. The roots are dug out by means of three-pronged forks, and the greatest care must be taken to prevent injury to the crowns when the leaves are taken off.

It must be observed that all stored roots weigh less after a time than they do when brought from the field, and some imagine that they become therefore less nutritious. But such is not the case, as the loss of weight arises from the loss of water, of which they contain, when fresh, from 80 to 90 per cent, and not from the loss of nutritive matter. This, as well as the security of the crops, and the fact that the land is left clear for ploughing, are all good reasons for attending in proper time to the "root harvest" of the farm, and every detail connected with it.

RETROSPECTIVE NOTES ON FARM CROPS AND CROPPING.

No. II.

IN our last article we gave at the conclusion a rapid *resumé* of the system or theory of selection as introduced and adopted by Mr Hallett, and promised to glance in a succeeding paper at what agricultural authorities thought of the system, and its adaptability to practice: that promise we now purpose briefly to redeem. A well-known authority, who has himself been instrumental in introducing several varieties of grain, maintains that improvement in the quality of grain is *not* to be secured by *cultivation*, however careful, but that it can be best attained by "selecting new and superior varieties, which nature occasionally produces, as if inviting the husbandman to stretch forth his hand and cultivate them." By cultivation of course is meant the usual routine of farm management, as the working of the land, and the application to it of manurial substances. In support of his views, that mere cultivation will not secure fixity unless there be also an artificial impregnation of the florets, this same authority says, that although he has selected and grown from single ears about two hundred varieties, and undertaken their management during growth, yet he has never witnessed "any tendency towards their improvement." He has also, he states, walked thousands of miles through wheat-fields, and grain-samples numberless have passed through his hands, yet he "has never seen any grain which has been either improved or degenerated by cultivation, so as to convey the change to the succeeding crop." So far as the experience of the writer of the present Notes goes, his opinion is very much in the same direction as that of the authority above quoted—very much, but not altogether so; for he has observed that there is generally an improvement by careful selection and cultivation up to a certain point—a point, however, very rapidly reached—but that, after that point has been reached, degeneracy in the quality and quantity of the grain begins. We believe that there is a capability of improvement in all our plants, but we do not believe, or rather we are

not inclined to believe, that there is a "fixity" of improvement, so to speak. It is indeed difficult to believe that, as a practical farmer while discussing this selective system says, "it is possible so to treat seed-corn that it becomes capable, like the improved shorthorn, of continuing the same valuable qualities under other circumstances than those under which it was reared." The same writer says, that he does not believe that the most careful selection and the most thorough cleaning—which, in point of fact, constitute the very essence of the old and practical system—have anything to do with the "new doctrine of pedigree." Not a few farmers he has known who have raised their oats and barley and wheat from a bushel or two picked out of many quarters; but he asks, Who ever heard of their attributing to grain so raised the "properties which pedigree in cattle confers?" they merely say that such and such seed was "clean, true to kind, and of fine form and colour." As, however, some may misconstrue or misunderstand what is meant by the term "pedigree" in wheat, we deem it right to offer Mr Hallett's own explanation of it, which was called forth by the discussion consequent upon the publication of his views. He says, "The principle alluded to is that of the continued selection of the best parent plants (as proof of the best grains), which selection, for the sake of brevity, I call 'pedigree.'" The most vigorous parents, Mr Hallett maintains, can only be known when all have free play for the full development of their powers and peculiarities; and that can only be given to them by giving them all the space which their growth can possibly require. Hence he deduces the absolute necessity of growing the plants in "selecting plots." The practical value of "pedigree" Mr Hallett maintains to be in its offering, and in fact giving, the means—the only possible means, as he decidedly characterises it—of increasing the produce of the cereals, and its universal applicability, no matter where these be grown. The value of this "great principle," as Mr Hallett terms it, is abundantly evidenced, not only, he says, by the result of the competition of his with other varieties, but by its competition, after selection, with *itself* in its original state, and in its various stages of selection. It certainly does seem a strong point in favour of this system of selection, that, as stated by Mr Hallett, the original ear was in five years doubled in length, trebled in contents, and its tillering powers increased eightfold. We have, however, known cases, and amongst others our own, where the "pedigree" wheat, under the most careful treatment, did not increase, but, on the contrary, deteriorated in value. On the other hand, in favour of the selection system, it is right to draw attention to the point to which a very eminent and practical agricultural authority has also drawn attention—namely, that "show, fruit, root, and plants" are gained on the same system of selection; and he says that, having seen year after year how much finer was the produce of wheat obtained from the grain sown thin, he was struck with the notion that something

might be done in the way of its further improvement by carefully selecting, and as long ago as thirteen years since he set two women to work in a barn to draw out the finest ears in the sheaves. The grains from these were taken out, and the best of these selected; in this way a bushel of extraordinary fine seed was obtained, which was drilled in drills a foot apart, and at the rate of only two pecks to the acre. The plants, as they came up, were twice hoed by Garrett's hoe, carefully hand-weeded, and kept clean up to harvest. The produce obtained by this mode of culture and selection was such as to justify further perseverance in it, but which was put out of the experimenter's power through circumstances. Such, then, may be taken as a fair view of the *pros* and *cons* of this selection system, which has created, and is still creating, considerable discussion in the agricultural world, and has added another to the somewhat numerous list of vexed questions which will never be anything else than vexed questions, so long as the practice of agriculture is controlled by such a wide variety of modifying circumstances as soil, climate, locality, and difference in the nature and in the application of manurial agents.

The discussion, or rather review, of this selection system, most naturally brings us to the points connected with the "sowing of the seed," and a review of what has been advanced in favour or condemnation of the "thin-seeding" system, which, like other systems, has in no small degree engaged the attention, and called forth the opinions—as various as the quarters from which they emanated—of many agricultural authorities. And, first, as to the modes practised in the sowing of seed. These are broadcasting, drilling, and dibbling. Of these three modes broadcasting and drilling are the most generally practised, dibbling being quite exceptional. Broadcasting has this advantage of being quickly done, so that, in "catching weather," the soil being already and fully prepared, the seed may be got safely in by it from the rapidity with which it is effected, while by the slower operation of drilling the opportunity of fine weather may be lost. The great objections to broadcasting are the large quantity of seed it involves, and the encouragement given to the growth of weeds. These are both obviated, at least to a considerable extent, by the drilling system; the quantity of seed being less, while the spaces between the drills enable the hoe—hand or machine—to be worked in spring. The quantity of seed can also be regulated by the drill to the greatest nicety. An objection to the drilling system has been made, and doubtless in some districts truly obtains—namely, that in consequence of a loose continuous furrow being made from one end of the drill to the other, the ravages of the wire-worm are aided. This can be avoided, however, by running a Crosskill roller *across* the line of the drills, thus breaking up each drill into short spaces. The great point is to stop the continuity of the path of the wire-worm, and to force it to come up

to the surface at each plant, rather than move from plant to plant. "Dibbling" is just as much in advance of drilling as drilling is in advance of broadcasting, so far as the saving of seed is concerned, and the capability of keeping the growing plants clean and free from weeds. Taking a review of the circumstances attendant upon the growth of the wheat plant, there can be no doubt that the mode of sowing which dibbling presents to us does indubitably enable this growth to be best developed. On this point we have already enlarged in the first of the present series of articles in the last number of this Journal, and we therefore dismiss our notes of its advantages by simply pointing out, that not only do we enable the plant to tiller well out in the early stages, and to give plenty of room for the later stages of its growth, and for the light and air to play around it, but that we obtain a stronger plant, finer straw, and richer ears. There is one fault, however, which we have found in our own practice to be dependent sometimes upon the dibbling—namely, the rust which the plants are liable to—we say sometimes, for not always is this rust an accompaniment of dibbled grain. In some instances we have also noticed that while the deteriorating influence of rust upon broadcast and drilled grain upon its quality was very marked, this was not the case with rusted dibbled grain; indeed, there has been always a something very different, on a close inspection, between the kind of rust which infects dibbled grain and that which we have noticed in grain sown in the usual methods. What that difference is we are not at present prepared to say, but it appears to us as likely that the freer access of light and air to dibbled grain, as compared with broadcasted or drilled grain, does bring about a less virulent kind of rust. Certainly, so far as we have noticed—and we have examined no small number of specimens—the influence of rust upon the *grain* of the dibbled wheat has in no instance been so marked as in the case of grain broadcasted or drilled. As to the width or distance between the drills in drilled corn, Mr Lawrence of Cirencester has the following:—

"I had observed some years ago, that practically the question of width lay between 7 and 9 inches, and the quantity of seed varied between 2 and 3 bushels per acre. Desirous of arriving at some conclusion on these points for my governance on my own farm, which comprises heavy and light land, I have, during the last five years, sown several half-acre plots in the same field, varying in width from 8 to 12 inches between the rows, and with from 4 to 8 pecks of seed per acre. Any one who has tried such experiments will have found, on comparing those of one year with those of another in different fields, very perplexing discrepancies, arising from the variety of land sometimes occurring in the same field, and other disturbing causes. It is, therefore, only by repeated experiment year by year, in different fields, that a reliable impression can be arrived at. The result of the experiments on my farm has been in favour of 12-inch intervals, and 6 pecks of seed. The largest produce I had in any year was from 4 pecks of seed with 12-inch intervals. I may add, these experiments have been made indifferently on light stone brash and tenacious soils on stiff clay. During seasons in which mildew has been prevalent, I have observed that it has to

a somewhat greater extent attacked the straw of the 12-inch than that with 8 or 9 inch intervals—a result I should not have anticipated *a priori*.”

On this point of narrow and wide drills the following tabular statement of the results of experiments carried out by Mr Birch Wolfe will be suggestive. The land was marked out in the centre of a 50-acre field of wheat—two plots being arranged of $5\frac{1}{2}$ roods each—one plot being sown at the rate of 6 pecks per acre, with the drills 9 inches apart, and the other plot with 7 pecks per acre, the drills 7 inches apart.

9-INCH DRILLS.

Seed per Acre.	Number of Sheaves.	Produce of 20 Sheaves.			Total assumed Produce of the $5\frac{1}{2}$ Roods.			Produce per Acre.		
		Bush.	Pks.	Qts.	Qrs.	Bush.	Pks.	Qrs.	Bush.	Pks.
6	996	1	1	2	8	1	1	5	3	6

7-INCH DRILLS.

7	936	1	2	4	9	4	0	6	3	5
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It should be stated that the 9-inch drills had the advantage of being hoed. It will also be noticed that the quantity of seed was not equal in both cases. Much of the value of experiments of this sort is lost through the inadvertence or carelessness which prevents the simple rule being attended to that the trial should be equal in all respects. Here the question to be decided was the influence of width of the drills upon the seed sown, and yet the quantity of this was not equal in both cases. In another trial, by the Messrs Dixon of Welham, in Essex, the quantity of seed used in the two widths was very properly the same, at the rate of 3 bushels per acre. The width of the stitches or furrows was in both cases 10 feet, but one-half of the stitches carried 19 rows or drills, the other half 13 rows. The whole quantity of seed thus sown in equal divisions of 19 and 13 rows or drills to the stitch of 10 feet, was 3 roods 37 poles. The produce was as follows :—

19 rows, 348 sheaves, 23 bush. $1\frac{3}{4}$ pks., weight, net, 106 stones 8 lb.
 13 „ 374 „ 21 „ $0\frac{1}{4}$ „ „ „ 96 „ 8 „

The narrow rows did not stand up so well as the wide, but yielded a shade the better sample. The soil was of a mixed quality, and the seed was of the variety known as “the golden drop.”

“Dibbling,” or setting, as it is sometimes called, is by many spoken of as a new thing. It is not so; in fact its practice on an extended scale was commenced so early as 1765. In old magazines, and specially in the original reports of the oldest of all our agricultural societies—namely, the Bath and West of England—which reports, by the way, are now difficult to be had—we find abundant evidence given of the advantages of the dibbling or setting system. The result of the inquiries made by the Secretary of the Society, in

the latter part of the last century, showed that both as regarded quantity and quality the dibbled wheat was superior to the broadcasted; the ears of the wheat were indisputably larger, the grain of greater bulk, and specifically heavier, while the berry of the corn was more equal throughout, few small grains being mixed with it. The average quantity of seed then used being 3 pecks per acre, the cost of dibbling it being 6s. per acre, and the average increase of produce as compared with broadcasting being two bushels per acre; in one well-authenticated case the increase was 8 bushels per acre, and in price 6d. a bushel better. The following description of the method adopted in the practice of the period we have already alluded to, will be useful at the present time, when the dibbling system is on the increase. The wheat is generally planted upon a clover lea; and if it be very light, it should be ploughed a week or ten days before the dibbling is commenced. In this light land a fall of rain will not be disadvantageous, as the soil will be so far solidified as to enable the holes to be made easily, and to be maintained perfectly open till the seed is dropped. Where the land is heavy, the ploughing should be done only a day or two before the dibbling; and in this soil it is absolutely imperative that the sowing should be done early in the season, as it is impossible to dibble properly in heavy land in wet weather, the dibble-holes simply becoming a series of little wells, in the bottom of which the water collects and rots the grain. The land being ploughed, a man should follow the plough with a spade and break down or level the furrow where this may have been left uneven by the plough; then a roller is to be passed over the surface. The dibbling then commences, which is carried out either by women or by men. The dibble is made of iron, 2 feet 9 inches in length, with a wood handle; the lower part of the dibble is made of a conical form, and calculated to make, when forced into the soil up to its neck, a hole 2 inches deep. The dibbler walks backwards, and after forcing the dibble into the soil, before drawing it out, or rather while in the act of drawing it out, turns it partly round; this consolidates the sides of the hole, and keeps it open till the seed is deposited. The holes are made on the top of the furrow, at distances 3 inches from each other. The seed grains, two or three in number, are dropped in the holes by children who follow the dibblers, two grains being dropped in at the early part of the season, three at the later part. After the grains are deposited, the land is bush-harrowed twice or thrice, according to the lightness of the soil, and in the same day.

At a time when so much is being written concerning planting or dibbling wheat with wide spaces between, it will really be interesting to glance at an experiment, or rather series of experiments, made *eighty years ago*, in "order to discover what produce wheat would yield," and the account of which we have disinterred from a rare volume now before us. Several rows were planted, each row

20 feet long, and the distance between the rows 2 feet; and the following tables show the results:—

No. I.—CROP OF FIRST YEAR.

No. of the Experiment.	Number of grains per hole.	The number of inches distance between the holes.		The number of the holes per foot.	The number of grains set in each foot.	The number of ears per hole.			The number of grains from each ear.	The number of grains from each grain.	The number of grains per foot.	Number of the grains in each square foot.
		Holes.				Ears.						
I.	2	3	4	8	46	23	184	31	713	5704	2852	
II.	7	12	1	7	55	76	55	34	267	1870	935	

No. II.—CROP OF SECOND YEAR.*

I.	2	3	4	8	16½	8½	66	38	312	2508	836	
II.	2	12	1	2	53	26½	53	35	927½	1855	618½	
III.	7	3	4	28	25	3½	100	39	139	3900	1300	
IV.	1	12	1	1	52	52	42	218	2184	728	728	
V.	3	12	1	3	55	18¾	55	45	825	2475	825	
VI.	3	12	1	3	57	19	57	41	779	2337	779	

No. III.—CROP OF THIRD YEAR.†

I.	2	3	4	8	10	5	40	51	255	2040	680	
II.	2	12	1	2	31	15½	31	51	790	1581	527	
III.	7	3	4	23	18½	2¾	74	51	134	3774	1258	
IV.	7	12	1	7	42½	6	42½	44	264	1848	616	
V.	1	3	4	4	18	4½	72	56	1008	4032	1344	
VI.	1	12	1	1	29½	29½	29½	56	1652	1652	550	

These tables show that the greatest increase is from 1 grain in each hole, the holes 1 foot apart, and the rows 3 feet from each other—the produce of 1 grain per foot being 52 ears, 42 grains in the ear, or 2184 grains per acre; and as the rows are 3 feet apart, each grain has 432 inches of space, so that the produce of a square foot is 728 grains. A greater produce per square foot was obtained by having the holes 3 inches apart in the rows—that is, 4 holes per foot more, or 28 grains per foot, and 7 grains in each hole—the produce in this case per square foot being 1300. *But the actual increase of grain per acre, as compared with 1 grain in each hole and each hole a foot apart, was much less; in place of being 2184, as above noted, it was only 139—a very re-*

* Rows 20 feet long, 3 feet apart.

† Twelve rows were planted, two of each with the number of grains as given in the Table No. III., the rows 28 feet long and 3 feet apart.

markable difference; but with 4 holes per square foot, and 1 grain in each hole, produced more than the 28 grains above noted—that is, 1008 grains per acre, and 1344 grains per square foot. Where *two* grains were put in each hole, the distances being the same, the produce was *reduced* to 255 grains, and to 680 grains per square foot, so that *half the produce only was obtained by the expenditure of double the quantity of seed*. These facts, elicited many many years ago, have a close bearing upon the questions of pedigree and thin seeding, which are now attracting the attention of the agricultural public. Some points were further illustrated and suggested by the experiments we have just been glancing at, so that it will not be time altogether lost if we glance further, but briefly, at them. It having been noticed that the produce decreased with the increase in the quantity of the seed, a series of experiments was carried out to discover if this was a rule. The experiments were conducted both in the garden and in the field, and barley was the seed used in the garden—wheat in the field. In the garden the rows were 3 feet distant; some were planted at 1 foot in the rows, some with 1 grain, some with 2 grains per hole, and some with 14 or 15 per hole, and others with more holes per foot than one. In the field they were planted 9 inches every way (see our paper in last number of this Journal for details of Hallet's system); the first row had 1 grain in each hole, the second had 2 grains per hole, the third 3, and so on up to the fifteenth row, which had 15 grains per hole—each row thus increasing one grain per hole. In May, the grain from the holes with the greatest number of grains looked the best, both of the barley and the wheat; the grain from the holes with 1 grain was very bad. When further advanced, this general result was still the same—the grain from the holes with 1 grain in each being so very bad as to dissipate all hopes of a produce from it. But as the season advanced those plants improved surprisingly, and were very good, and ultimately yielded 20 ears per hole, others with 1 and 2 grains yielded 10 ears per hole, and those with 14 or 15 grains per hole yielded 15 ears per hole. Many of these facts now given are very instructing and suggestive.

We have yet, however, before leaving this department, to advert to the mode of raising a crop of wheat by *transplanting*. This method has had some attention directed to it of late, from the circumstance of one great difficulty attending upon these new, or, from what we have detailed of old experiments, what we may call revived, modes of raising crops of wheat—namely, the getting ready the land in time to admit of the *very early* sowing which thin seeding or dibbling necessitates. By planting a small space in the corner of a field, or in the garden, at an early period—say August or September—a number of plants may be raised to be good and vigorous when the land is ready in autumn. The fol-

lowing, from the 'Agricultural Gazette,' will be interesting on this point:—

"A few years ago an experiment was tried at the model farm of Glasnevin, near Dublin (suggested by the one recorded by the celebrated gardener, Miller), of transplanting wheat in the spring, parting the roots so as to make each plant into ten or more. The crop was as good as from a field sown in the usual way. It may be worth considering whether this plan might not be advantageously tried if we are to have another wet season; for the very weather which is utterly unfit for sowing is the best for planting; according to the well-known proverbial maxim, 'Set wet, and sow dry.' Some persons, not well acquainted with country affairs, might suppose the process to be much more tedious and more costly than it is. They will perhaps be surprised to hear of the payment made by many nursery gardeners in England to the women and children employed in transplanting small forest trees (about a finger long) from the seed-bed. They pay 2d. a thousand; and many children are glad to earn in this way from 4d. to 6d. per day. It is even found to answer in some parts of England to sow wheat in the way that is called 'setting' or 'dibbling,' dropping the grains by hand into holes made for the purpose; as, indeed, is always done with beans. It would not take much more time and labour to lay the little offsets of the wheat in a shallow furrow, and then slightly cover them over. And as some set-off against the expense of labour is to be reckoned the saving of the seed-wheat. But, however, the alternative is not between sowing or planting a field of wheat (the former being in such a season as this impossible), but between the planting and the leaving of the field absolutely waste for a whole season."

There is "nothing new under the sun," and it holds good of this new thing of transplanting; for perhaps the most complete record of what has been done in transplanting of wheat, is to be met with in papers published eighty years ago in the 'Transactions of the Bath and West of England Society,' a glance at the leading features of which will here be interesting. Thus, a Mr Bogle—the name need not be taken as ominous by our Scottish readers—states that he has known wheat transplanted in September, October, November, February, March, April, and even as late as the middle of May, all of which have answered well. And the result of what he observed in connection with the subject led him to believe that wheat is not an annual, but a perennial, provided it is eaten down by sheep, or cut repeatedly by the scythe or the sickle, so as to prevent the plants coming to ear (for a very suggestive note on this point, see a recent article on thin seeding by the Old Norfolk Farmer, in this Journal). Mr Bogle estimated that the plants required for one hundred acres could be raised in a plot of one acre. And we may here state, that, planted at distances of nine inches each way, 77,440 plants will be required for one acre. A very remarkable feature connected with the mode of transplanting is the enormous increase we can obtain by it, when we divide the original plant, giving each part to a separate hole, care being of course taken to have at least one rootlet to each divided part transplanted. There is a well-authenticated experiment carried out by a Mr Owen Miller of Cambridge, in 1769, who obtained *from one single grain*

the enormous produce of 21,109 ears, the corn from which measured three pecks and a half, and weighed forty-seven pounds. This was obtained by the following mode:—On the 2d of June 1766, the wheat (common red) was sown, and on the 8th of August a single plant was taken up. This was divided into 18 parts, and each part planted separately. These tillering well, some were taken up in September and again divided, and the remainder were allowed to remain in the ground a little longer, till between that time and the middle of October the whole were taken up and divided: the result of the final division being the obtaining of 67 plants. These 67 plants were allowed to tiller all winter, and in spring, between the middle of March and the 12th of April, the whole were taken up and divided into 500 plants; these plants were the final planting, which produced, in the aggregate, the enormous number of ears noted above—21,109 ears. Some of the roots produced 100 ears, and many of the ears produced measured *seven inches in length, and contained between sixty and seventy grains.* Wheat is by no means a difficult plant to transplant; it takes kindly to the ground, and stands even a sharp frost well. The produce of wheat transplanted in the autumn—say October—is greater than that transplanted in the spring—say in March; the result of one experiment may be represented thus:—winter 20, spring 8. We have already said that in transplanting wheat it is necessary, or considered necessary, that the plants should have tap-roots. We tried a good many plants with and without tap-roots, and so far as the readiness of the plants to take to the ground was concerned, we could not trace any difference. All we planted, of both kinds, took at once, and those having no tap-roots were merely white at root, and did not certainly look as if they could possibly strike. We mention these facts in corroboration of the statement that the wheat plant is a very easily transplanted one.

On the subject of thin and thick sowing a vast deal has been written, and some of the points involved have been alluded to in an article in this Journal by the Old Norfolk Farmer; but we may, in order to render our Notes complete in every department, add a few in connection with it, without touching on the ground occupied by that valuable and suggestive article, but rather, on the contrary, as supplementary to it. In the seventh volume of the 'Journal of the Royal Agricultural Society' there is an article by Sir W. Heathcote, Bart., on thick and thin sowing, which may be epitomised here with advantage. One conclusion arrived at, and at which indeed all experimenters have arrived, is that *early sowing is essential in thin seeding*, giving to the thinnest sown the chance of early tillering—an advantage second only to high cultivation in securing good crops from reduced quantities of seed-corn. The following is one table of results:—

EXPERIMENT OF 1845: THRASHED AT ONCE.

No. of lot.	Measure of land.	Pecks sown at rate of	Sheaves in lot.	Produce in the best quality.			Weight per Bushel.	Produce in the second quality.			Weight per bushel.	Straw.		
				bsh.	pks.	gall.		bsh.	pks.	ga.		cwt.	qrs.	lb.
1	2 10	9	447	23	3	0	65½	2	1	0	56	11	0	17
2	2 11	7	251	16	2	1½	63	1	2	0	59	7	2	12
3	2 9	6	331	18	2	1	62½	1	0	3½	56	9	3	0
4	2 12	5	284	16	2	1½	62	0	3	1	49	8	1	19
5	2 8	4	285	19	0	1½	62	1	0	0	55	9	2	5
6	2 7	3	326	18	0	1½	61½	0	3	1	38	11	1	11
7	2 18	9	539	21	0	1	63	1	0	0	56	12	2	19

EXPERIMENT OF 1846: THRASHED AT ONCE.

							gals.							
1	1 11	4	218	12	2	0	62	1	52	7	5	0		
2	1 11	5	216	10	0	0	62	3	55	8	2	0		
3	1 11	6	170	11	0	0	62½	3	55	8	0	0		

In the same number of the 'Journal,' Mr Mechi, so well known as an advocate for thin sowing, has the following table and remarks:—

Date of Sowing.	How Deposited.	Quantity of Seed per acre.	Quantity of Land	Produce per acre.	Quality of Soil.	Remarks.
Oct 29	Bentall's Dropper	4 pks.	3 acres	40	Poor tile earth, very tenacious	2 to 3 kernels in each hole, 6 in. from row to row.
" "	Newberry's Dibbler	4 "	3 "	38½	"	8 to 9 kernels in each hole, 11 in. from row to row.
Nov. 1	Bentall's Dropper	4 "	1 "	35	"	<div> <div>Most straw and corn from the smaller quantity of seed.</div> <div>The thin-sown a week later in ripening. This an invariable result of trials in thin seeding.</div> <div>The 4 and 5 pecks were unfortunately not kept separate.</div> <div>The smallest quantity of seed was estimated as the greatest produce.</div> </div>
" "	Drill	8 "	5 "	34½	"	
" 24	Newberry's Dibbler	2½ "	1 rood	30½	"	
" "	Drill and Dibbler	9 "	3 acres	32	"	
Nov. 10-20	Bentall's Dropper	4 "	1 "	48	Feltly bog	
" "	Hand-dropped	5 "	1 "			

Remarks by Mr Mechi follow the table, of which the following is an epitome. Thin sowing should be early sowing on heavy

land ; this is the invariable result of all thin-sowing trials. The land should be drained, subsoiled, and kept free from weeds by the hand or horse hoe, if thin sowing is to be a success. On light lands and bog the wheat plants are apt to be devoured by the wire-worm, to prevent which the roller should be freely used. On reclaimed bog or deep rich vegetable soil, Mr Mechi says, it is imperative to sow thinly, three or four pecks to the acre, or the crop would be mostly straw. Thin sowing somewhat delays the ripening of a crop, especially if sown on heavy land so late as November or December. Anything beyond one bushel of seed per acre has not had an effect of increasing the yield, the extra seed being *so much wasted*. The plants from the one bushel of seed Mr Mechi found kept their healthy green colour throughout, never having turned yellow in spring. This, we may remark in passing, we have found to be an invariable attendant upon the plants of thin-sown wheat, a healthy greenness most refreshing to look upon. But the two-bushel plants, Mr Mechi says, turned yellow, the three-bushel plants still yellow, and were decidedly the worst plants in the field. Mr Mechi, in a later communication to an agricultural journal, has the following, the perusal of which will be interesting :—

“ It must never be forgotten that thin sowing is the parent or first cause of large and vigorous ears to select from ; on this point there can be no mistake, seeing that thick sowing has an exactly reverse effect, diminishing and crippling the growth of the ear, until, with extreme quantities, there is scarcely a good kernel or good ear. Therefore in order to get good ears to select from, we must sow moderately. It would be a very dangerous experiment to sow generally so small a quantity of seed as one peck per acre. In highly-cultivated warm mellow soils, free from weeds, and in good heart, where harvest is ready by the 1st of August, or earlier, such small quantities may be sown, provided the sowing is done early ; but we must ask ourselves how much, or rather how little, of the land of this kingdom is in the state I have described. One kernel in a hole, at intervals of nine inches by four, would, under favourable circumstances, be ample, and produce much more than if four times that number were sown ; but, then, we have rooks, French partridges, birds, mice, and wireworm to contend with.

“ The latter may be easily got rid of by sowing or ploughing-in rape-cake, with or without salt, the latter to be commended. Light-land men would be astonished to see our cold tenacious birdlime-like seed-beds in a wet seed-time, even where well drained and deeply cultivated. The seeding of friable manageable soils cannot be compared with such a state of things. Besides, the time of harvesting depends upon the quantity of seed sown, and the period at which it is sown.

“ It is all very well to talk of sowing in September, but in many districts this year all hands were then employed in harvesting, and in late districts seed-time will probably be November and December. On my own farm experience has taught me the danger of so small a quantity as one peck per acre, and I know of some cases this year where one peck of Mr Hallett's wheat on one acre has been found to produce only three quarters of inferior quality per acre on land which generally produces five or six quarters. Parties who have been thus unsuccessful should, equally with those who are successful, communicate their results for the information and guidance of their brother farmers.

"Absurd quantities of seed continue to be sown as a general practice; but I would advise my brother agriculturists to feel their way down to a proper minimum quantity, suited to their soil and climate, by small experiments in their fields. I see so many farms where weeds are allowed to luxuriate and perfect their seeds, almost undisturbed, in competition with the cereal crops, that in these it would be the height of folly to attempt thin sowing. There they must sow thick, to preoccupy the ground and smother the weeds, as they will not clean-hoe. Thin sowing, to be successful, demands, like a thinned turnip-crop, a frequent use of the hand and horse hoe, to which much of the land of this kingdom is still a stranger."

While much has been written on the advantages of thin sowing, thick sowing has not been without its advocates. It is well known that broadcasting is more in general favour in Scotland, and some districts of England, than drilling; and it is hard to believe, as suggested by Mr Barclay, "that so great an advantage in the saving of a bushel and a half of seed per acre can have been overlooked for so many generations. It seems more reasonable to suppose that long practical experience has taught the farmer the more prudent course of a liberal supply of seed." Mr Barclay, here quoted, in a communication to the 'Royal Agricultural Society's Journal,' gives the result, in a tabular form, of some experiments in the three modes of sowing corn—dibbling, drilling, and broadcasting—which are remarkably in favour of broadcasting; and which, he says, if not conclusive against the thin-sowing mode now so much advocated, should, at all events, induce caution on the part of farmers not to depart hastily from the practice of their forefathers. The experiments detailed in the table here given were conducted with great care, on level land of uniform quality, a good deep loam on chalk subsoil, and the crop was preceded by clover lea folded by sheep. The land was ploughed 5 inches deep, as it was not thought desirable to bring the sheep-dressing below that point. The seed was sown on the 7th December, and the dibbled and drilled wheat was hoed in the following spring: the broadcasted was harrowed in the spring. The plants on the thin-sown plots were by far the healthiest-looking throughout the season; but when harvest approached the quality of straw and grain was soon shown to be inferior. The samples of the different lots were valued by an experienced miller.

No.	Quantity of Seed per Imp. Acre.	System of Sowing pursued.	Grain Produced.	Weight per Bushel.	Straw Produced.	Value of the Grain.	Value of the Straw.	Total Value of the Produce per Acre.
1	2½ bushels	Drilled 9 in. apart	Head, 34 Tail, 3 — 37	lb. 64½	70	Head, at 7s. per bushel, . . £11 18 0 Tail, at 6s. " 0 18 0 £12 16 0	At 36s. per load, £3 10 0	Grain, £12 16 0 Straw, 3 10 0 £16 6 0
2	1 bushel	Drilled 12 in. apart	Head, 22 Tail, 3 — 25	62½	51	Head, at 6s. 6d. per bushel, { £7 19 6 Tail, at 5s. 6d. " }	At 30s. per load, £2 2 6	Grain, £7 19 6 Straw, 2 2 6 £10 2 0
3	1 bushel	Dibbled 12 in. apart	Head, 28 Tail, 3 — 31	67½	63	Head, at 6s. 9d. per bushel, { £10 6 3 Tail, at 5s. 9d. " }	At 33s. per load, £2 17 9	Grain, £10 6 3 Straw, 2 17 9 £13 4 0
4	1 bushel, 3 pecks	Dibbled 9 in. apart	Head, 34 Tail, 3 — 37	64	72	Head, at 6s. 9d. per bushel, { £12 6 9 Tail, at 5s. 9d. " }	At 33s. per load, £3 6 0	Grain, £12 6 9 Straw, 3 6 0 £15 12 9
5	2½ bushels	Broadcast	Head, 37 Tail, 3 — 40	65	84	Head, at 7s. per bushel, . . } £13 17 0 Tail, at 6s. " . . }	At 38s. per load, £4 4 0	Grain, £13 17 0 Straw, 4 4 0 £18 1 0

Mr Barclay seems to have been aware that the shallow depth to which the land was ploughed must have had an influence upon the productiveness of the thin-sown samples ; but, even admitting this, he thinks that the large difference between the produce obtained could have hardly been made up had the land been ploughed deeper. It seems to be pretty well established, that where thin sowing is practised, deep and effectual tillage of the soil is imperatively necessary ; and it certainly is a strong point in favour of the thin-seeding system, that it does thus involve the necessity of deep and careful stirring of the soil and its weeding ; for where these are attended to, bad farming can scarcely be said to exist. Further, Mr Barclay has overlooked the fact that early sowing is an essential element of success in thin sowing ; and from our own experience alone we should have had no difficulty in predicating that the thin seeding carried out so late as the 7th of December would not produce either good quality or great quantity of grain or straw. Be it noted here that *we* are not advocating thin against thick sowing ; it is our duty chiefly to draw up the retrospective notes, adding to them here and there such remarks as we can give, likely to elucidate any of the points opened up. Indeed, so far as the question is concerned, we should be disposed to counsel that it be kept an open one ; for we feel assured that no one mode of practice is universally applicable to all localities, irrespective of soil and climate. In one locality, with peculiarities of soil and climate understood, we might strongly advocate the adoption of the thin mode of sowing, while in another we would as strongly advocate the very reverse mode of proceeding ; and yet we could give a reason why we did so which would abundantly clear us from the charge of inconsistency. A firm conviction of this great truth, that agriculture is not a fixed science, but open to all the disturbing influences of elements themselves disturbed—as soil, climate, locality, difference in manurial and regenerative agents—would, we feel assured, keep down the persistency, or shall we say the dogmatism, of those who, with good reason—and this may well enough be admitted—believe that their theory or mode is well founded upon facts derived from their own experience, nevertheless err in supposing that that experience is applicable to all districts, no matter how widely the difference may be between their peculiarities of soil and climate and those of their own. We repeat a truism when we say, that the real progress of agriculture has been much retarded by the persistency with which some have advocated the application of a system to all localities and soils which has proved of value in their own. Agriculture is specially the art in which repeated trial and experiment is desiderated ; and the trials and experiments must be conducted by each one for himself. And, as Lord Portman remarks, “a series of experiments for many years in the same district is required to settle the question in such district. In one large district it is found best to sow 2 bushels of seed in drills at 9 inches apart ; and that is there the general system. In another

more or less seed is required, dependent upon climate, soil, elevation, exposure to wind, game in more or less abundance, birds, insects, &c.; *no one rule is good for every district.*" On the same point Mr Miles says, "I feel convinced that very many circumstances, to be determined alone by the tenants of the respective farms, must decide the quantity of seed to be sown in the respective localities." Again, Mr Loft remarks, "I do not believe that any specified quantity of seed can be laid down as the proper quantity for all descriptions of soil and climate; practice and experience must alone be the guide; for although I am willing to admit that wheat tillers well on this soil (Lincolnshire marshes, a loamy clay on a strong tenacious clay subsoil), I find, from repeated trials, that it is not safe to sow much less than 8 pecks to the acre on an average. I now generally begin seed-time with 7 pecks as the minimum, gradually increasing as the season advances to 9 pecks per acre." Mr Roberts, to whose essay on 'The Management of Wheat' we shall presently refer, states that the quantity of seed varies from 4 to 10 pecks per acre, but that it depends entirely upon circumstances, as the time of sowing, the manner of sowing. The poorer the land, the greater must be the quantity of seed. On a poor, gravelly soil, where manure is not attainable, 10 pecks drilled at from 6 to 8 inches will be the least quantity required; wherever, in such soils, this quantity is at all sensibly decreased, in like proportion both quality and quantity of the grain is decreased also. If $2\frac{1}{2}$ bushels are used broadcast, 2 bushels will be equivalent if drilled, and 5 pecks if dibbled. The following table, as given by Mr Birch Wolfe in the 'Journal of the Royal Agricultural Society,' as to the "proper quantity of seed for wheat," will appropriately close this department of our subject. The soil was heavy clay in good heart; the seed used was of the Spalding variety. The produce from each plot was very nearly the same; the dibbled failed most in plant, but tillered well, and yielded rather more than the rest; but in proportion as the plant was thin, so was the grain coarse and light. Mr Wolfe has come to the conclusion, that in soils similar to his own, and taking an average of seasons and all other circumstances into account, there is great risk of loss in drilling at a greater distance than 8 inches, and with a less quantity of seed than 6 pecks per acre. The following is the table given by Mr Wolfe:—

Width of Drills in Inches.	Seed at rate per Acre.	Produce in Sheaves.	Produce in Grain from the 3 Rows.			Produce at rate per Acre.			Weight per Bushel.
			qrs.	b.	p.	qrs.	b.	p.	lb.
9	5 pecks.	689	4	0	0	5	2	2	62 $\frac{1}{4}$
6 $\frac{1}{2}$	7 do.	665	4	0	0	5	2	2	62 $\frac{1}{4}$
8	6 do.	681	4	0	3	5	3	2	63
Dibbled and dropped by hand at 8 in.	6 do.	692	4	1	0	5	4	0	61 $\frac{1}{2}$

B.

BADENOCH FARMING.

THERE are some, we daresay, to whom the very name of Badenoch conveys a dim idea of a Scotch Siberia, inaccessible to all but the most adventurous spirits, and rejoicing in a climate which may be represented as something like nine months of winter and three of bad weather making up the year. We know at least that our own ideas of Badenoch were rather of that nature until we made our first acquaintance with it some five or six and twenty years ago ; but as we jogged leisurely along on a stout Highland cob, from the Dan to the Beersheba of the district, we felt strongly impressed even at that time with the possibility that much might yet be done in Badenoch towards developing its latent agricultural capabilities. Having travelled through it several times since the period we have mentioned, our first impressions of what might be done were deepened, especially when we took into consideration what was doing elsewhere with much worse materials to work upon. At that time, however, although traversed by a mail-coach road, it was in a manner shut out from the rest of the world ; but at last the shriek of the steam-engine has wakerred up the echoes of its grand old hills, and Badenoch is brought in direct contact with all those busy hives of industry whose food-requirements swallow up not only all which British farmers do as yet produce, but every bushel of grain and every pound of meat which can be collected from the surplus of every nation on the face of the earth.

It has afforded us great pleasure, therefore, to learn that our previsions of what Badenoch might yet become are in a fair way of being realised. We gather this from the reports which have come under our notice of a meeting of the Badenoch and Rothiemurchus Farming Society, which was held at Kingussie in October, and at which, in addition to an excellent show, one of those practical discussions, which we hold are the life-blood of farming societies, took place, the subject being the system of farming best suited for the district.

It must be borne in mind that, while some of the mountain-ranges of Badenoch are 4000 feet above the level of the sea, the arable land of the district lies at an elevation of from 700 to 1100 feet. We are not to expect, therefore, that a system of farming which would suit the warm plains of Moray would be found adapted in all respects to the natural features of such a district as Badenoch ; but the principles of good husbandry are everywhere alike, and are quite as applicable to Badenoch as to Berwickshire. Sheep and cattle are the principal sources of agricultural wealth in Badenoch, and the system of arable farming pursued in the lowlands of the district must be carried out with special reference to its live-stock ; and while we are not to look for wheat fields on the haughs of Upper

Speyside, we may at least expect to meet with prime crops of turnips, and fields laid down, in good heart, with the best and most suitable kinds of grasses.

Mr Macdonald, Strathmashie, who opened the discussion, is an out-and-out hill farmer, who "stuck to his hill," as he said, though he thought the soil of Badenoch "was the best in the world." He had tried arable farming so far as to prove that "he could grow crops as high as himself," but they yielded nothing! He had limed and dunged, but all in vain; and his evidence would have been depressing enough if the chairman, Cluny Macpherson, had not elicited the important facts that Mr Macdonald had omitted to drain before he ploughed, and, in the next place, that he was altogether inexperienced in cultivating arable land; so that his evidence might be altogether set aside, were it not for the admission he made, that unless he wintered his lambs well he was sure to have plenty of deaths among them; and as one great object in arable farming in such a district as Badenoch, and, in fact, in any district, is to provide abundance of winter keep for stock, it is evidently "Strathmashie's" interest, and the interest of all who, like him, "stick to their hill," that arable farming shall be carried on as far as possible in those parts of the district which are adapted for it.

We candidly believe that the right nail was hit on the head when Mr Macpherson, Killihuntly, said that the best system for the low-lying lands in Badenoch was "a mixed system," by which they would "let their arable land lie out five or six years in grass." Mr Macpherson's views were expressed in the following terms:—

"It was true that they had short summers and late harvests, but he believed they could improve the climate by draining the lands and making them drier. They could then sow their crops earlier, and they could hasten the ripening of them by liming the land, and putting artificial manures upon it, which they could now get much cheaper than formerly. On the whole, he thought arable farming should pay in this country as well as in any other country. Although they were high above the level of the sea, and far inland, they had as deep soil as they had in the Lothians, or in any part of Moray or Banff or Aberdeen shires. Labour was certainly high, and prices of grain low; but as long as they could calculate on getting 20s. a-quarter for corn, they would do, and if they did not get that, they could turn that out of it by giving it to their two or three year-old wedders or bullocks if they chose to feed them. Some people might say they would not get so much additional for them as would pay the extra feeding; but if they should not, they must calculate that the manure is a third more valuable when cattle or sheep were fed with oats or other extra feeding stuffs, than when they are fed upon straw and turnips alone. Those who had arable land along with their hill pastures, should try and feed their three-year-old wedders upon their low farms. He was going to try this himself, and he had no doubt it would answer well."

Although we have not given the usual newspaper marks of applause which some of Mr Macpherson's remarks appear to have elicited, yet we are glad to say that his views with respect to the

profitable returns which might be expected from giving low-priced grain to the fattening stock were cordially approved of by his audience; and we may state, with reference to this point, that it has been proved that so long as beef or mutton can be sold at 6d. per lb., feeding with oats which do not cost above 20s. per quarter does pay—that is, in connection with turnips. Indeed, we should say that the consumption by stock of the grain grown in Badenoch will be found, in most cases, the most profitable mode of sending it to market; for, even with the advantage of a railway, a considerable percentage must fall to be deducted from grain grown in that part of the country, when sent to market as grain, but which would be saved when sent in the shape of beef or mutton. The Badenoch farmers would in this manner make their arable farming auxiliary to their hill farming, and thus even the otherwise less favourably situated of them might ultimately turn out stock which would eclipse even the Strathmashie wedders, for which Mr Macdonald had got 32s., and the superior excellence of which some of the gentlemen at Kingussie seemed to think it was hopeless to rival.

Mr Macpherson's opinions were supported by Mr Cumming, who could not understand how he was to keep his stock all the year round if he let out all his farm in grass. "Ay, that's the rub!" There are plenty of people, however, who seem to forget this important point when they urge the propriety of what we consider, and what Mr Cumming evidently would consider, an undue extension of pasture. People should remember that "it is not always summer;" and a winter in Badenoch, or anywhere in the United Kingdom, without due provision for the wants of live-stock, is, at best, a miserable prospect. Yet that is just what some people would bring us to, if their views respecting farm management were universally carried out. "A hunger and a burst," as the old saying hath it; plenty of keep during summer, and starvation during the dreary winter and tardy spring.

Cluny Macpherson, as chairman of the meeting, took up the different points brought forward by those who had spoken on the subject under discussion, and, remembering that his home-farm was situated 1100 feet above the sea-level, showed that draining and planting were required to improve the climate, in order to permit those who were similarly situated to render their arable land available for the production of crops which would be useful for their hill stock; and with respect to what should be done in the mean time, as well as with regard to the future prospects of the district, he expressed his views in the following terms:—

"It struck him that a mixed system of farming was the best—a system combining the pastoral and the cultivation of their arable land to a certain extent. By improving their arable land, they might raise a certain portion of grain for their families, but that was all they could expect to do until the climate be improved. In the course of eight or nine years, when they had

opportunity of getting their arable land properly into cultivation, they might feed a large number of cattle, and send them south by railway. The resources of the country were certainly not developed; but his opinion was, that in the course of ten years hence Badenoch would be very different from what it was at present. By cultivating part of their arable land, by attending to their pastures—surface-draining them, and burning heather—and by liberal landlords, he had no doubt they would turn their rents out of their farms, and be encouraged to carry on improvements which would soon work a very great change upon the country.”

What one may call the views of the more advanced among the proprietors and farmers of Badenoch received strong confirmation from those of Mr Mollison, who, it appears, has been lately appointed the local representative of Mr Bailie of Dochfour, the new proprietor of Kingussie, and who is reported to have said, when giving his opinion of Badenoch and its capabilities for improvement,—

“Badenoch had hitherto been under great disadvantages in its means of communication with other parts of the world, but that was now all remedied, and it would not do for them to take shelter under the plea of a bad climate. He had no doubt but the climate could be improved. They wanted furrow-draining and deeper cultivation, with a liberal application of lime and artificial manures. Let them be in a position to labour their land in good season, and pulverise it thoroughly, and, with early sowing and good manuring, he had no doubt they could overcome the bad climate to a great extent. He knew intimately districts in the neighbouring county of Aberdeen, where late harvests a few years ago were the terror of the farmer; and now they grew the best grain that went into the city of Aberdeen, and sent south the best cattle that entered the London market. He did not say that Badenoch would reach all this, but there was a great deal in store for Badenoch.”

These we call the suggestions of a practical man who knows what he is about; and certainly the extraordinary illustrations which Aberdeenshire, Caithness, and other northern counties afford of successful agricultural improvement, even in spite of great natural disadvantages, are alone sufficient to stimulate people in other parts of the country to bring like intelligence, perseverance, and industry to bear on the development of resources which are as yet neglected and almost unknown.

There are one or two points bearing on this movement in Badenoch to which we shall briefly allude. The first is, the importance which several of the parties who spoke at Kingussie evidently placed on the capability of the district as a corn-growing country. We consider this point secondary to its capability for producing good crops of turnips and sown grasses, and we would even suggest to the Badenoch men the propriety of getting rid of the idea that it is necessary to sow down grasses along with a corn crop. The fact that grasses succeed better when sown without a corn crop than with one, was pointed out in the last number of this Journal; and as it is proposed by the Badenoch farmers to allow their land to lie out in grass for perhaps five or six years, we do most decidedly say, as the result of personal experience, they will find that the loss

they may imagine they would sustain by sowing down their grass seeds alone, or with a mixture of rape, will ultimately prove a great gain.

Then, this matter leads to the grasses they are to use, and we would earnestly advise them to look for something more useful than the mere ryegrass and clover with which it is usual to sow down land in many parts of Scotland. The permanent grasses must be introduced, otherwise their attempts to procure good pasture will prove comparative failures. And, when the principal objects they have in view are the provision of abundance of food for their cattle and sheep in the first place, and the thorough cultivation and enriching of their land in the next, before it is let out to grass, why not, in such a case, adopt the system of having two crops of roots in succession, varying the kind of roots and manures as much as possible? This system is carried out elsewhere with good results, and we are of opinion that it would be found well suited to answer the requirements of Badenoch farming.

There is another point to which we would refer before closing our remarks on this really interesting subject. While we are aware that there are both good cattle and good sheep to be got in Badenoch, we are also aware that there are some herds and flocks not quite up to the mark. "Strathmashie" goes, it appears, to Lanark for his lambs, and that very sensible step no doubt assists greatly in bringing about the satisfactory result alluded to by some of the speakers at Kingussie—namely, that "he gets 32s. for his wedders off the hill," which, as every one knows, even in these dear times, is a long price for blackfaced sheep. What one of their number has done, others of the Badenoch farmers may at least attempt. There is great room for improvement in many Highland flocks, and one great help towards improvement will be found in well-cultivated arable lands, when such exist in connection with a hill-farm. There was some talk, too, of "crosses" at Kingussie, when cattle were spoken of; but with all due respect to those who would favour crosses, and while we are perfectly sensible of the value of cattle of that kind, we would express an opinion that for Badenoch, even with increased and improved tillage, there is no description of cattle equal to their own native Highland breed. Let the Badenoch men stick to their Highland stock, improve it as much as possible in point of breeding, and be as liberal as circumstances will permit in point of keep, both summer and winter, and we maintain that more advantage will be derived by the owners from their Highland stock, than they will ever derive from any other kind of cattle.

We have devoted more attention to the sayings and doings of the Badenoch farmers than we usually bestow on those which are brought under our notice in the proceedings of other farming societies; but we have had an object in view in so doing. We are not without hopes that we may, perhaps, have done a little by our

cursorry observations in assisting to further the improvement of what has been hitherto a comparatively unknown and somewhat neglected part of the country; and we have been desirous also of giving greater prominence than usual to the matter, because there are other districts placed in somewhat similar circumstances, and the knowledge of what is doing in Badenoch may perhaps stir up people in those districts to adopt similar measures. If successful in either case, our object will have been accomplished; and we close for the present, wishing "God-speed" to the praiseworthy exertions of the Badenoch and Rothiemurchus Farming Society.

POPULAR WEATHER PROGNOSTICS.*

"To popular apprehension, the highest or ultimate object of meteorology is to enable us to foretell the weather. Looked upon in this point of view, science can as yet only offer abortive attempts, or such as hold out no promises for the future. In other respects, on the contrary, her advances have been assured, rapid, and brilliant." We shall not presume to speculate whether the illustrious Arago, if still among us, and acquainted with Fitzroy's forecasting of the weather, would have been induced to modify this opinion as to the hopelessness of expecting that scientific meteorology shall enable us to foretell the weather. It is certain, however, that he would have approved of the attempt now being made, by the Scottish Meteorological Society, to determine the worth of that "folk-lore" regarding the weather which has been current from the earliest times. "While," says he, "I am far from regarding proverbs and popular sayings in general as constituting codes of national wisdom, I am, at the same time, disposed to think that physicists have been wrong in treating with contempt those sayings or proverbs which refer to natural phenomena. It would, no doubt, be a great mistake to receive them blindly; but it is no less so to reject them without examination. Guided by those principles, I have sometimes found important truths where others had seen merely groundless and obstinate prejudices."

It was in this spirit of rational deference to the experience of the unlearned, that the Marquess of Tweeddale declared to the Meteorological Society that certain shepherds, without scientific apparatus, and simply by watching the aspect of the sky and the

* 'On the Popular Weather Prognostics of Scotland.' By Arthur Mitchell, M.D., Member of Council of the Scottish Meteorological Society, &c. William Blackwood and Sons, Edinburgh and London: 1863.

'A Prognostication of Right Goode Effect.' By Leonard Digges. London: 1555.

atmosphere, had been able to foretell the extraordinary snow-storm of 1861 in sufficient time to save themselves and their flocks from its disastrous effects. "He thought these natural observations ought to attract a much greater amount of attention than they had yet received; and as Dr Arthur Mitchell and himself were at present engaged in collecting such observations for the purpose of being classified and systematised, he hoped that they would receive every possible assistance from their country friends in their inquiries."

We have, in this Journal, repeatedly advocated the claims of this Society to a greater share of support, especially on the part of agriculturists. Very possibly the determination of the Society to enter upon the investigation of this very curious and interesting department of knowledge may excite more popular notice than has been excited by any of the important inquiries which it has been prosecuting. We hope that it will, and that the result will be an accession of reliable information to the public, and of much-needed funds to the Society. And should this hope be realised, the public and the Society will have equal reason to be grateful to the Marquess of Tweeddale for his valuable suggestion, and for his liberality in offering a prize of twenty guineas for the best scientific explanation of the prognostics collected by Dr Mitchell. To those interested in this inquiry, either as meteorologists or as writers for this prize, we recommend 'Forster's Treatise on Atmospheric Phenomena,' in which they will find an extensive and amusing collection of popular sayings regarding the weather.

Now that the matter is brought before us, we willingly give it publicity; and if few of our readers be sufficiently learned to compete for the prize, we hope that many of them will, for their own instruction, and as a contribution to the facts to be inquired into, set about testing the value of the prognostics relied on in their neighbourhood; and if they attempt to explain them on scientific principles, we venture to assure them that the result will be a very remarkable demonstration of the amount of their own ignorance! The *rationale* of these phenomena must be sought for in intimate acquaintance with "*rerum natura*," as Lucretius phrases it,—in other words, in knowledge of the laws which bind together all things animate and inanimate; sun and moon, rainbow and aurora borealis, falling stars and thunder; the aspects of mountains and of the sky; the varying sounds of the ocean, rivers, and cascades; subterranean noises, and the issue of gases and foul air from the crevices of mines; the movements of various plants; the proceedings of birds, fishes, and quadrupeds; the sensations of human beings; and a host of unclassified prognostics. The man who thinks himself qualified to inform us intelligently how all creation here below is in sympathy with that all-pervading something called the weather, must be a graduate of a university which communicates to those attending it a great deal more knowledge than we got at

Edinburgh College, or have managed to pick up since in the great school of daily life. Dr Mitchell's collection of weather-signs has interested us much, and, to tell the truth, has humbled us greatly. For instance, it was put into our hands on the 14th November, and, opening it by chance, the first thing we read was this:—"An unseasonably fine day in winter or spring is called a *pet day* in Scotland. The fate of pets, they say, awaits it, and they look for bad weather on the morrow." Well, the said 14th day of November was a *perfect pet*, and we resolved to note the aspects of next day throughout. The wind was westerly; the sky clear until 2 P.M., when it was overcast, and presented indications of rain; the thermometer in our hall at 9 A.M. indicated 54°, at 4 P.M. 57°. The day after (the 16th) the weather was still unseasonably mild—the sky lowering—the thermometer in the hall at 11 A.M. indicating 56°; the wind still westerly; but by 8 P.M. it shifted to the east, and it began to rain heavily. As on the 15th, it became hazy at 2 P.M., and looked as if the weather were about to alter, though the alteration did not actually occur till next day, we were disposed to allow that the popular prognostic had been verified, then came the necessity of trying to find out the reason why. Suppose this prognostic strictly verified, what is the connection between the *pet day* and its doleful successor?

We cannot offer even a surmise of what it may be, but fervently hope that the writer who gains the Tweeddale prize may have more philosophy than we have, or, at all events, more fancy, so that his sagacious guesses may set us speculating as to the causes of unexplained phenomena.

'Guesses after Truth, by Two Brothers,' is the modest title of a very delightful modern book; and if the meteorological guesses of the competitors for the Tweeddale prize find as many admirers, it will be worthily bestowed. We confess that in so wide a field we expect many explanations of meteorological phenomena which will only deserve to be called guesses; but that is no reason why these phenomena should not be classified and seriously examined: the guesses of the wise of one generation are often, to the next, demonstrated truths of great importance. And these popular prognostications of the weather, whether true or false, are important, as Dr Mitchell truly observes:—"Faith in such signs determines in no small degree the *actions* of shepherds, farmers, seamen, and others, by whom they are trusted in such a manner as to lead either to gain or loss. It is this consideration which gives to the study of them a practical value. They either mislead and cause loss of time and property, or they are useful and ready guides to be consulted and obeyed with profit. Their actual influence on conduct for good or evil makes it clearly desirable that their trustworthiness should be carefully tested."

It can hardly be doubted that there are natural indications which,

when long and accurately observed, give certain premonition of approaching atmospheric changes. No classes of men are so much interested in this kind of knowledge as farmers, sailors, and shepherds; and none have more ample means of observation. Whether farmers are generally as observant of weather phenomena as their interest should prompt them to be may be questioned, considering how few of them are members of the Meteorological Society. Sailors, for their own safety—shepherds, for that of their charge—are notoriously weather-wise. “I remember,” writes a friend of ours, “of being in company with the celebrated Sir Sidney Smith, when he visited Perthshire, many years ago. It was in autumn, and the grain was ripe in the fields, but the weather was so unfavourable that the labours of the harvest were at a stand. I observed to him that nobody understood the weather so well as sailors and shepherds, and I hoped he could give us some reason to expect a change. ‘Oh!’ said he, with the frankness characteristic of himself and of his profession, ‘I can do nothing among your mountains; but set me afloat in a known sea, with a barometer before me, and I will give you a rough guess of what you may expect.’ And he proceeded to say, that whenever he went to a new station, the first thing he did was to call around him all the oldest fishermen, and mark down all their signs and observations of the weather; and he added that he never found them mistaken.

Weather prognostics such as guide the movements of fishermen, sailors, and shepherds, are not to be laughed at because trusted in by those making no pretension to science. Let the scientific consult their instruments, and, if classically disposed, learn by heart the celebrated Addison’s Latin poem, entitled *Barometri Descriptio*; but let them not despise the *empirical* knowledge of the unlearned, handed down from the days of old, and trusted in because founded on experience.

As we declared, in our recent article on the eating of funguses, that we would, in a matter affecting the bodily senses, follow the opinion of a savage rather than of the Pope or the President of the Royal Society—so say we now of weather prognostics, that, being matters of fact such as any man living much in the open air can observe, the recorded observations of the illiterate are worthy of careful attention. They relate to matters in which they are daily interested, and, as such, are level to their capacity; and it is mainly to such observers that we are indebted for those prognostics in the explanation of which philosophers have as yet said so little that is satisfactory.

It is to the credit of such observers that our scientific meteorologists seem nowadays seriously disposed to test the value of those popular maxims which appear alike in the writings of ancient philosophers, and in those curious repositories of weather-wisdom—almanacs—which a recent French writer asserts are perhaps the

oldest books in the world, except the Scriptures. Aristotle, in his book *De Meteoris*, appears to have been the first of the Grecian philosophers to collect and systematise the various prognostications of the weather; and his speculations on meteorology, though often unsatisfactory, are sometimes—as in his remarks on *dew*—remarkable for their approximation to the discoveries of modern science.

His pupil, Theophrastus, wrote in a more popular style, in a work of four general divisions—viz., the prognostications of rain, of wind, of storms, and of fair weather. Socrates, too, seems to have been something of a meteorologist. The ribald poet, Aristophanes, held him up to ridicule in 'The Clouds;' introducing him in a basket drawn across the top of the stage, for the purpose, he was made to tell the scoffing mob, of making observations on the weather. The poets, both of Greece and Rome, also treated of the universally interesting subject of weather. Aratus, once the popular versifier of 'Phenomena' and 'Prognostics,' is now chiefly known to us because quoted by St Paul in his speech to the men of Athens, and because of his singular fortune in having had two such illustrious translators as Cicero and Cæsar Germanicus. Facts and fables, follies and superstitions, are so mingled in the meteorological portions of the poetry of Lucretius that they do not merit serious consideration. No reader of the 'Georgics' needs to be reminded that far higher heed should be paid to the weather-wisdom of Virgil. Believing him to have been an accurate observer, it would be interesting to compare the prognostics which in his day indicated change of weather, with those which are still relied on by the people of Italy; and should some Italian meteorologist be induced to make the comparison, we should anticipate new confirmation of the persistency of the popular faith in natural indications of coming changes in the condition of the atmosphere.

Passing from the philosophy and poetry of the ancients to the kalendars and almanacs of times nearer our own, we come upon a singular repository of strange things about men and animals and the weather. As a contrast to a quarterly report of the Meteorological Society, we think our readers will not be displeased to be furnished with a few specimens of popular meteorology as set forth in some of the old almanacs of England and France.

We begin with 'A Prognostication of Right Goode Effect, by Leonard Digges; imprinted at London, within the Black Fryars, by Thomas Gemini, 1555.'

It commences with "many pleasant and chosen rules for ever to judge of alteration of the weather." First, according to the day on which the moon changes: if on Sunday, dry; if on Tuesday, windy; if on Wednesday, wonderful; if on Thursday, fair and clear; if on Friday, mixed weather; if on Saturday, moist weather.

We are also told that the planets influence the weather; and

lastly, that the day of the week on which New Year's Day falls determines the general character of the ensuing year. Thus, if on Friday, we shall find "the somer scante pleasant; harvest indifferent; little store of fruit, wine, and honey; corn deare; many bleare eyes; youth shall die; plenty of thunders and tempests; with a soden deathe of cattel."

New Year's Day on Saturday prognosticates "a mean winter; somer very hot; a late harvest; good chepe garden herbes; plenty of hempe, flax, and honey."

As might have been anticipated, the stars, according to Digges, are very potential. The conjunction of the sun and moon indicates "a very unhappy day for all matters; therefore neither plante, build, sow, nor journey." When Venus is in conjunction with the moon, "then is the time to sow, to marry, to follow all manner of pleasant pastimes, and not unmeet to hire servauntes or to let blood."

In our rather horrifying article on 'Hirudiculture,'* we dwelt upon the incomprehensible tendency of people in the country to part with their own blood periodically; and, within two years, we were shocked to hear of a farmer near us bleeding all his young cattle, for no better reason than because it was "gude i' the spring-time."

To return from this digression to the weather, we expect the special thanks of agricultural readers for next introducing to their notice a very singular production: 'An Everlasting Prognostication of the State and Condition of every Yeare, by the onely Kalender of Januarie, written by that auntient learned Leopoldus Austriacus, and others, for the commodity of the wise husbandman.' As 1864 begins on a Friday, the vaticination of the learned Leopoldus is unusually interesting. Here it is:—"If the first daye of Januarie happen on Fridaye, then shall the winter be very cold and dry, the springe boysterous and wette, the summer temperate, the harvest more wette than drye, so that blear dewes and other diseases, with the filthinesse of matter, and running in the eyes, is to be feared; and the *pin* and *webbe* is likewise to be doubted to happen that year. And young children shall then dye, and a likelihood that young women shall be lured into love through the flatterye and great persuasion of men. Also plenty of fruites is then promised, though much haile fall that year."

Our far-seeing, learned man, is also kind enough to give us a peep into the coming year, by teaching us to interpret the state of New Year's night. "If it be calm and cleare, without winde and raine, then doth the same promise a prosperous year following; and if, the same night, the wind happen to blow out of the east, then doth the same signifie the dearth of cattle; and if, the same night, the wind happen to blow out of the west, then a likelihood of the death of kings or princes to ensue that yeare. If, in the same night, it blow

* See Journal, No. 64, March 1859.

out of the south, it signifieth the death of many persons that yeare ; and if it blow out of the north, a small yielde of all the fruits of the earth that yeare."

In Dr Dee's 'Almanac newly set forth,' in 1571, we have prognostics of the weather as indicated by natural objects,—the redness of the moon foretelling wind—the moaning of the sea, storms—the early flight of swallows, a severe winter. All these, and the inevitable "Thirty days hath September," &c., we find just as in an almanac of this year.

About the end of Elizabeth's reign, almanacs appear to have become a necessity for all classes. "John Wodehouse, philomath," is not so wise as a man should be with such a title. He tells us that cabbages are to be sown in the wane of the moon, and radishes at the increase ; that gilliflowers are to be planted "in an old moon," and parsley sown at the full.

Turning to France, we find the almanac the same strange mixture of the useful with the absurd. M. Nisard, in his work on the colporteur literature of France, gives an interesting account of one of the oldest, which is in vogue to this day in the remoter districts of the French empire. 'The Shepherds' Kalendar'* is profusely adorned with woodcuts alarmingly contemptuous of drawing and perspective. The frontispiece gives us the shepherd's portrait, his bagpipes under his arm, while the shepherds, each with bagpipe or flageolet beside him, are sitting round in various attitudes of attention and wonder, with a dog in the foreground, apparently as much surprised as any of them. The shepherd, prefacing his discourse with the remark that "shepherds who lie in the fields at night see many signs," now commences a marvellous meteorological lecture, in which the sun, moon, and planets play a very subordinate part compared with comets, flaming stars, and fiery dragons. This lecture is profusely illustrated with woodcuts. A comet, very hairy and very fiery, with a tail resembling a broomstick ; stars with bats' wings, about to pounce on the astonished shepherds' heads ; and an unmistakable dragon, with staring eyes and a most voluminous tail, breathing out volumes of smoke. The shepherd does not say much about them, probably deeming their portraits quite sufficient ; he tells us, however, that all manner of mischief is to be expected from their appearance.†

After perusing such vagaries one cannot help wishing that there may be truth in Coleridge's assertion, "In the *imagination* of man exist the seeds of all moral and scientific improvement ; chemistry

* 'Le Grand Compost, et Calendrier des Bergers, composé par le Berger de la Grande Montagne ; fort utile et profitable à gens de tous états.'

† Those desirous of knowing more about such productions should read 'Kalendars and Old Almanacs,' in the 'British Quarterly Review,' October 1858. It is very amusing, and we are indebted to it for several of the statements in this article.

was first alchemy, and out of astrology sprang astronomy." In that case, meteorology having for long been the product of imagination, is destined some day to rank among the exact sciences, and confer upon mankind signal benefits.

Finding that almanacs, British and foreign, are to a great extent the chosen vehicles through which the weather-wise communicate with the public, we have been induced to extend into Germany our research after prognostics. We have been rewarded by stumbling upon the 'Göttingen Pocket Almanac for 1779,' in which a collection of the most authentic observations of recent writers on "the pre-sensations" which animals have of the weather. Being too ignorant and too indolent to compete for the Tweeddale prize, we benevolently help the coming essayist by making him acquainted with the observations of Dr F. A. A. Meyer of Göttingen.

He classifies these pre-sensations under three heads—the pre-sensations which animals have (1) of fair or dry weather, (2) of rainy weather, (3) of stormy weather.

As to the pre-sensations which animals have of fine or dry weather, here is the theory of the Göttingen *savant*. Clear dry weather generally follows after wet weather, when the atmosphere has been freed from the vapours collected in it by their falling to the earth in rain. Clouds as well as rain are the means by which the air frees itself from the electric vapours that are continually arising; and if these, again, fall down, it appears very natural that animals which live chiefly in the open air should express, by various movements, the ease with which they breathe and perform all the vital functions. This pre-sensation is highly useful to bats as well as insects; their wings not being protected against moisture by any oily matter, rain would render them heavier, and unfit for flying.

Dr Meyer supposes that, on the approach of dry weather, larks and swallows fly high because the upper regions of the atmosphere are freer from vapours, and because the insects on which they feed then probably take a higher flight. He also alludes to the weather-fish (*Cobitis fosarlis*) kept in Germany for the purpose of foretelling weather; because, when the weather is fine, it continues quiet, but is restless before rain or storm. As Dr Mitchell does not enumerate fish among the animals whose proceedings prognosticate rain or other atmospheric change, we suggest this as a topic for investigation. Every angler knows how often his sport is marred by a change of wind, by impending rain, and specially by the approach of thunder. In order that they may be always under observation, fish in ponds, or in vessels in the house, should be attentively watched. If the quiescence of a leech in a bottle denote fine weather, and if its mounting to the top of the water and clinging to the sides of the bottle betoken rain—as, from experience, we think to be the case—we should expect to gather weather-wisdom from the pre-sensations of fish in confinement. Speaking of leeches, we remember of being

struck with a curious application of the motions of a leech. An ingenious Frenchman, in the Great Exhibition of 1851, exhibited "an animal barometer" in the shape of an apparatus so arranged that the movements of a leech were indicated by the ringing of a bell.

As to the pre-sensation which animals have of rainy weather, Meyer supposes that this may be explained by the increasing weight of the atmosphere, by their manner of living, and by the want of moisture necessary to their existence. People who have wounds or old ulcers experience contraction and heat in the parts affected; why, then, should not the skins of animals be similarly influenced? This, in Meyer's opinion, explains why horses and asses rub themselves, shake their heads, and snuff the air by turning up their noses; why asses bray much and jump about; why cattle scrape up the earth and stamp with their feet; and why swine, though not hungry, eat greedily, and dig up the earth a great deal with their snouts. Our learned instructor from Göttingen may think so; we have our doubts, and beg to enter a special caveat against the libel on pigs—"Eat greedily, *though not hungry*." We believe they have more sense. They have good appetites, let us be thankful, otherwise we should not have such good hams. If Göttingen swine behave like gluttons on the approach of rain, we can only say that our magnificent pig has no such evil custom, and eats his meals, foul day or fair day, with an equanimity which makes us envious.

As to the pre-sensation of rain inferred from the increased biting of fleas, of that also we have no personal experience. We admire the modesty which prompts the declaration, "This we cannot explain, as the natural history of this and other similar insects is as yet too obscure." This modesty makes us benevolently hope that rain does not fall in excess at Göttingen, and that the liveliness of fleas is consequently not discomposing to the natives. As to the pre-sensation which animals have of storms, our German doctor is surely quite astray when maintaining that hitherto this has been observed only amongst the most perfect of *mammalia*—namely, man and the dog; and we doubt not that he was dreaming in the clouds—pipe-begotten—when generalising thus:—"It appears, in general, that the more imperfect animals remark only the approach of dry weather, the more perfect the approach of rain, and the most perfect the approach of storms."

"The dog, on the approach of rainy weather, expresses signs of uneasiness, scratches himself, because the fleas then bite him with more violence, digs up the earth with his feet, runs round, and eats grass; he is accustomed, however, to do the latter when he is very hot, perhaps to cool himself; and, in general, a storm follows soon after." Well, it may be so at Göttingen; and if the professors there report as to the habits of fleas in assailing human beings, we shall listen with deference. These lucubrations as to the doings of fleas

with the canine race are open to suspicion, because, though dogs are our good friends, they are unfortunately unable to explain their sensations meteorologically; and as our dog seems to eat grass because he needs physic, we are not prepared to grant that when German dogs are graminivorous the sky will soon growl out thunder. In short, we cannot accept either the facts or the philosophy of Dr Meyer. So far is it from being true that only man and the dog have been observed to have a pre-sensation of storms, that, among the prognostics of quadrupeds, Dr Mitchell has collected the following for investigation:—Goats leaving high and exposed ground, and seeking shelter in a *bield*, or in some recess; old sheep and ewes eating greedily; swine carrying straw in their mouths, and tossing about their bedding; moles raising their hillocks more than usual; hares taking to the open country before snow.

Coming now more especially to some of the prognostics noted by Dr Mitchell for verification, we find that it is believed that the low flight of crows indicates rain, and that if, when flying high, they suddenly dart down and wheel about in circles, wind is expected. We can only say that, if they do, we can suggest no explanation of such proceedings; and that if the crowing of the cock at unusual times prognosticates rain or snow, we are quite at a loss to explain the augury. It is certain, however, that, from the earliest times, ravens and cocks have got credit for being weather-prophets.

The landward flight and flocking of sea-gulls are supposed to presage wind according to the old rhyme—

“Sea-maw, sea-maw, go sink in the sand;
There’s never good weather when ye’re on the land.”

We refer to it because it is the subject of a discussion in Sir Humphrey Davy’s ‘*Salmonia*,’ the disputants being Poietes, a poet, and Ornither, a sportsman:—

“*Poiet*.—I have often seen sea-gulls assemble on the land, and have almost always observed that very stormy and rainy weather was approaching. I conclude that these animals, sensible of a current of air approaching from the ocean, retire to the land to shelter themselves from the storm.

“*Orn*.—No such thing; the storm is their element. I believe that the reason of this migration of sea-gulls to the land is their security of finding food; and they may be observed at this time feeding greedily on earth-worms and larvæ, driven out of the ground by severe floods; and the fish on which they prey in fine weather in the sea, leave the surface and go deeper in storms.”

We are not disposed to ascribe the landward movements of gulls to premonitory instinct, and rather conceive that, having had a foretaste of the storm, they have fled from its violence to places where they know that they will find shelter and food. Their movements thus indicate commotion at sea as already begun, and consequently furnish no premonition of the weather to be expected inland. Moreover, it is to be remembered that their visits inland

are at a certain season for the purpose of rearing their young. One of their chosen haunts for nidification is among the chain of lakes betwixt Dunkeld and Blairgowrie. This gives rise to a singular traffic. Cart-loads of their eggs, boiled hard, are sold all over Strathmore, and are very palatable.

In a different part of the country—in the vicinity of Kirkcudbright—we were repeatedly witnesses of what seemed to give us quite an original idea as to the origin of the word *gullibility*. Living at a gentleman's seat, our attention was directed to a pair of sea-gulls, which, we were informed, were in the habit of regularly coming once a-year, accompanied by a couple of their young. Perched on the kitchen chimney-top, the cry of "the gulls are come," sent all the boys of the family to the favourite amusement of feeding the gulls. Each armed with a *bicker of brose*, we pelted the gulls with balls of the solid stuff till we thought they should have burst. Not one of them was ever missed, and the amazing rapidity with which they disappeared down the capacious maw, satisfied us that gullibility, however characteristic of human beings, is specially descriptive of the sea-maw's power of swallowing.

Insects also figure as weather indicators. Incidentally we have already touched upon the sensitiveness of the leech to atmospheric changes. Ants are so sensible of cold that the finest day will not tempt them to place their eggs, or pupæ, at the top of the nest should the air be chill; and it was remarked so long ago as the time of Pliny, that, before bad weather, they are in a bustle to secure their eggs; "forewarned, no doubt, by the perception of an altered temperature," thinks Professor Rennie, who, in his charming 'Insect Miscellanies,' ascribes the sensitiveness of ants, bees, and other insects, to the same sort of feelings which in human beings give warning of bad weather in the form of gouty and rheumatic pains.

As might be expected in creatures so amazingly gifted with instinct, bees are living barometers. When they fly to the hive and none leave it, rain is believed to be near—and with good reason, we think; for Huber records that, while collecting honey in the fields, the working bees are so feverishly afraid of bad weather that a single cloud obscuring the sun sends them homewards.

Spiders are reputed to be so weather-wise that a foreign naturalist* asserts that, when it is wet and windy, they spin only very short lines; "but when a spider spins a long thread, there is a certainty of fine weather for at least ten or twelve days afterwards." Kirby admits that his observations are in the main accurate, and adds:—"I have reason to suppose that a very good idea of the weather may be formed from attending to these insects."

We believe that we were the first, some five-and-twenty years

* D'Iajonval.

ago, to publish the singular circumstance that, excepting the chief lines, the webs of spiders are sometimes taken down with as much care as they are constructed, and that this is always before rain. Professor Rennie writes:—"We have tried numerous experiments by moving and vibrating the lines of many species, so as to imitate, as nearly as possible, the entrapment of a fly; but in no case have we succeeded in bringing the spider to the spot, because, as we inferred, her eyes always detected our attempted deception." We once were so clever as to cheat a spider. Gently shaking a very small hook, called the midge-fly, in the lowest line of her web, our barometrical friend—whose pre-sensation gave warning of wet—was fairly taken in. Rushing on the hook and grasping it, great was her astonishment. Finding that she should not believe her eyes, she precipitately fled; and no subsequent temptation, though renewed weeks afterwards, enabled us again to boast that we excelled Professor Rennie in angling for spiders.

Though naturalists differ as to the degree in which insects give premonition of atmospheric changes, enough is known to make it very desirable that their relations to meteorology should be systematically studied. Insects are undeniably very susceptible of varying temperature. Kirby and Spence tell us that this susceptibility is probably due to electricity perceived by the antennæ. Rennie is rather disposed to refer it to electricity acting on the hairs with which most insects are beset, and adverts to the fact that bees, which are such electrometers, are among the most hairy of all insects. This surmise is probably well founded, and suggests observation of the fur of animals as likely to furnish important meteorological indications. As this is not noticed by Dr Mitchell we submit it for his consideration.

The vegetable kingdom also opens up a curious field of investigation, in which the meteorologist will learn much regarding the mutual interdependence of all departments of creation. If light and electricity be so influential in exciting the movements of animals breathing the vital air, plants are equally subject to the same potent agencies, and testify to their influence, mutely, it is true, but so visibly as to attract the notice alike of the scientific botanist and of the illiterate rustic. In some parts of England the peasants mark the blooming of the large water-lily, and think that the number of its blossoms on a stem indicates the price of wheat per bushel for the ensuing year—each blossom being equivalent to a shilling! We smile at this as superstitious folly; but even philosophy does not disdain "the poor man's weather-glass"—the pimpernel (*Anagallis arvensis*)—and is too wise to despise the weather indications afforded by the shutting of the flowers of the small bindweed, the wood-anemone, the wood-sorrel, and the common daisy, which appears to have derived its expressive name—day's eye—from its sensitiveness to the light.

Such phenomena, as Dr Mitchell notes, are probably determined by the action of light; and the flowers of such plants being shut at 10 or 11 A.M., tells of cloud and gloom, and so predicts rain. It has been ingeniously proposed to form a floral timepiece from an arrangement of plants whose periods for opening and closing their flowers are known. The star of Bethlehem expands its flowers about 11, and closes them at 3 in the afternoon. The goat's-beard closes its petals at noon, and hence its provincial name of go-to-bed-at-noon. And that light is a chief agent of these changes, is proved by the experiments of Decandolle, made at the *Jardin des Plantes*, in an underground cellar, illuminated by lamps giving a light equal to fifty-four ordinary wax candles. By lighting these he could cause the flowers of the star of Bethlehem to open at pleasure, and also those of the sea-chamomile, which keeps its flowers closely shut during the night; but he could produce no artificial effect, with the strongest light, upon several species of wood-sorrel, whose flowers and leaves are both folded up at night. With the sensitive plant he succeeded in so completely changing the hour of closure, that on the third day from being placed in the lighted cellar it began to fold its leaves in the morning and open them in the evening.

But not only do very many animals and plants afford popular weather prognostics—these are also found abundantly in the aspects of the sky, in the sun and moon, in the aurora borealis, falling stars, and thunder.

Dr Mitchell, as to these, indicates a very wide field of inquiry, and remarks that "the accusation of fanciful can with most fairness be brought against those prognostics which are associated with the aurora, halos, mock suns, thunder, &c." If he had included among the dubieties those connected with the moon, he would have agreed with most physicists, although it must be avowed some of the most distinguished of these hold that lunar influences do affect the weather. "No observation," says Mr Daniell, "is more general, and on no occasion, perhaps, is the almanac so frequently consulted, as in forming conjectures upon the state of the weather. The common remark, however, goes no further than that changes from wet to dry, and from dry to wet, generally happen at the changes of the moon. When to this result of universal experience we add the philosophical reasons for the existence of tides in the aerial ocean, we cannot doubt that such a connection exists. The subject, however, is involved in much obscurity." Supposing the connection to be demonstrated, we need not despair of tracing the reason of it. Thanks to Mr Piazzi Smyth, and other recent observers, we are acquiring new information as to matters lunar, which in due time will, we doubt not, be traced out in their relation to things terrestrial; so that to them we shall not always have to apply the observation of Pliny—"The cause lies concealed in the majesty of Nature."

While hesitating to acknowledge the effect of the aurora on the

weather, Dr Mitchell attaches great importance to the following prognostic observed by Professor Christison:—"For a period of between thirty-five to forty years I have never known an exception to the rule, that the first great aurora, after a long tract of fine weather in September or beginning of October, is followed on the second day—and not till the second—about one o'clock on the east coast, and about eleven o'clock in Nithsdale, by a great storm; and that the next day after the aurora is fine weather, fit for all agricultural purposes." Although, then, the same phenomenon may, by different persons in the same locality, be made to predict totally different conditions of the weather—though the aurora has been thought to predict wind by some, and war by others—while the Esquimaux fancy that it is a game which is played by the departed spirits of their relatives—nevertheless, there is room for rational investigation. More than thirty years' observation by one so cautious as Professor Christison is not to be put aside, especially when Fitz Roy makes this acknowledgment: "Among the more experienced seamen who have visited many climates, an opinion prevails that lightning, the *aurora*, meteors, or shooting-stars, are indicative of disturbance in the air, and foretell wind or rain, if not both, in no long interval of days."

Dr Mitchell may also be less sceptical as to halos, when reminded that Sir Humphrey Davy writes thus:—"As an indication of wet weather approaching, nothing is more certain than a halo round the moon, which is produced by the precipitated water; and the larger the circles, the nearer the clouds, and, consequently, the more ready to fall."

"A rainbow in the morning is the shepherd's warning;
A rainbow at night is the shepherd's delight;"

why, of course, he cannot tell. The explanation of Davy is this:—"A rainbow can only occur when the clouds containing or depositing the rain are opposite the sun, and in the evening the rainbow is in the east, and in the morning in the west. As, therefore, our heavy rains in this climate are usually brought by the westerly wind, a rainbow in the west indicates that the bad weather is on the road, by the wind, to us; whereas the rainbow in the east proves that the rain in these clouds is passing from us."

As to the old faith, that "the evening red is the sign of a bright and cheery day," Dr Mitchell notes, that the red after sunset must have a *crimson* tinge, and must last for some time. Davy, however, maintains that the red must have a tint of *purple*, which tint portends fine weather, for this reason: "The air, when dry, refracts more red or heating rays; and as dry air is not perfectly transparent, they are again reflected in the horizon. I have generally observed a coppery or yellow sunset to foretell rain (*Salmonia*)."

In regard to underground prognostics—such as the increased flow

of water in mines—these are rendered credible by what Arago relates in a singular chapter of his *Meteorological Essays*, in which he shows that where the atmosphere is tempestuous, there are simultaneously great perturbations in the interior of the earth, and at or below the surface of waters.

For instance, in the Vicentine Hills, when a thunderstorm is preparing, the fountain of Bifoccio, even when it is apparently dried up, suddenly overflows its basin, and fills a wide channel with muddy water. Again, an Artesian well near Perpignan, which at first furnished an abundant gush of water, suddenly stopped. One day when the sky was covered with heavy storm-clouds, there was heard a subterranean bubbling sound, soon followed by an explosion, after which the Artesian well again flowed as at first.

About three miles from the spring of Bifoccio, there is, in the courtyard of Signor Pigati of Vicenza, a deep well, which, at the approach of a thunderstorm, seems in a state of ebullition—sounds issue from it so as to spread alarm among the neighbouring inhabitants. In like manner there is at the Mont d'Or, in Auvergne, a stone basin, called Cæsar's Basin, through which gushes a spring, the increased noise of which is regarded as an infallible indication of the approach of a thunderstorm. Arago, in connection with these and similar phenomena, seems disposed to admit that, when thunderstorms are gathering, water has a tendency to rejoin the clouds, manifesting itself by decided phenomena of intumescence; so that it is certain the meteorologist does well when submitting to careful investigation underground prognostics of the weather.

Altogether, the diversified phenomena to which we have been directing attention, though apparently unconnected, will in all probability be found allied together by some pervading law, the discovery of which will go far in the solution of the mysteries which at present beset the study of meteorology. If there be any who think it derogatory to philosophers to invite them to the humble task of gleaning the few grains of truth scattered through the wide field of popular meteorology, we pray them to remember that the objects on which the illiterate found their prognostics of the weather may be known and read of all men; and that the learning of the wise is never better employed than when investigating the reality of facts which Nature appears to delight in revealing to the senses of the humblest of her children.

A SCOTCH LABOURER'S COTTAGE, AND HOW TO WARM IT WITH ONE FIRE.

BY SIR JAMES STUART MENTETH, BART.

"But a bold peasantry, their country's pride,
When once destroyed, can never be supplied."

AMONG the many suggestions that have been made for the improvement of the cottages of the rural population, I do not remember to have seen anything advanced on the subject of an improved method of heating them. It appears to me that it would be a matter of no small consequence if any satisfactory plan could be devised and adopted, by which the cottage could be more comfortably heated; and that at a reduction, rather than increase, of expense to the inmates.

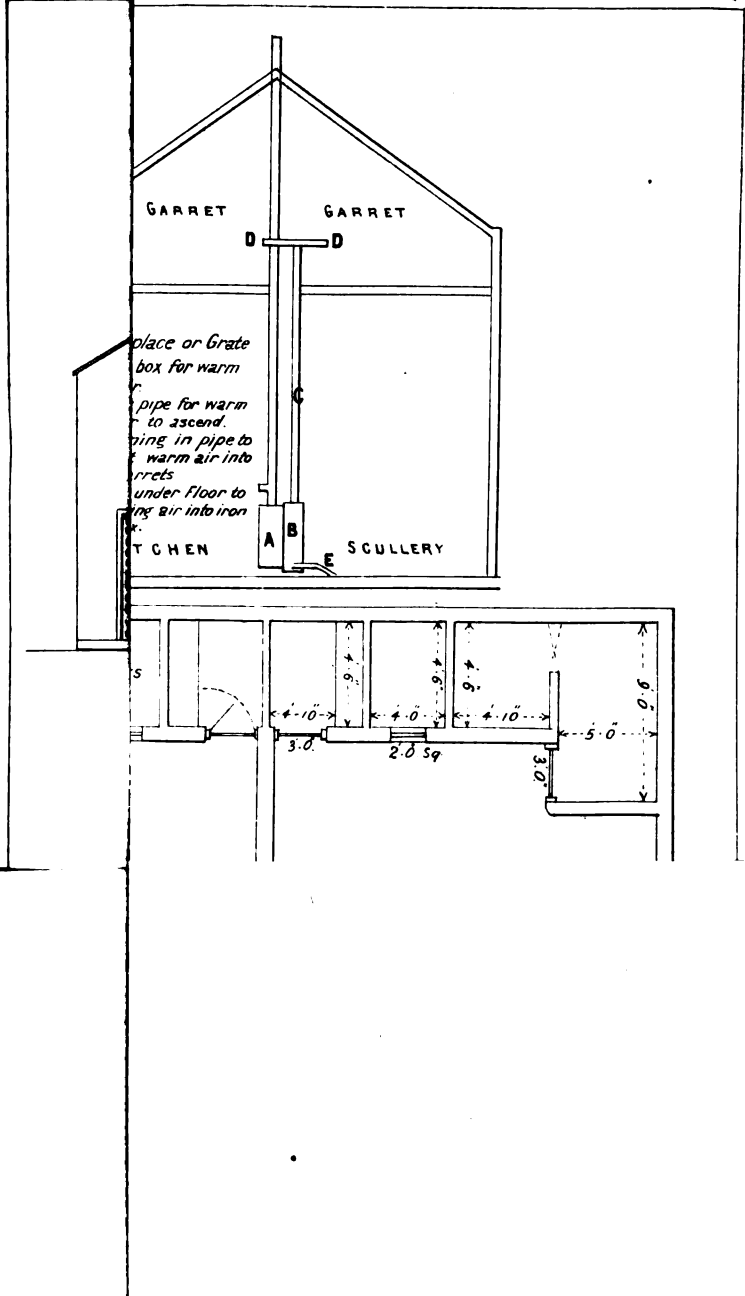
It is admitted that, in the ordinary way in which our dwelling-houses are heated, whether large or small, much of the heat escapes and is lost. This subject has engaged much of my attention, especially with regard to the cottages of our rural population. I now submit, for the consideration of my readers, a plan which has suggested itself to me, by the adoption of which I trust and believe that the object I have in view would be accomplished. It is a plan by which one fire might be so arranged as to heat comfortably four apartments—two on the ground-floor and two up-stairs.

The cottages of Scotland are so constructed that the fireplace is usually situated in the gable-end of the building. A cottage of four apartments—two on the ground and two above—has two fireplaces, one in each gable-end. No arrangement is made for the heating of the two up-stairs rooms; in other words, they have no fireplace. This, in my opinion, is a bad arrangement as respects the subject in hand—the heating of the cottage.

Besides describing my mode of heating, I have submitted a *Plan** to illustrate it, applied to a double cottage, which, I think, would prove a commodious and comfortable dwelling for two families of cottagers, and the expense of which would not be extravagant.

Each of these cottages would have two apartments below; two garret bedrooms above; and behind, enclosed in a small yard, several conveniences for the comfort of the family.

* In the *Plan* given and appended to the description of my mode of heating two cottages, these cottages are purposely devoid of all architectural ornament, to keep down expense. When this is not so much an object, the appearance of the cottages might be improved by projecting the roof over the walls. The upper windows might be thrown out of the roof, and the under ones have mouldings round their heads.



The probable expense of this double labourer's cottage I believe would not exceed £269, or perhaps less.

In the plan of this double cottage, it will be seen that the fireplace and chimney are placed in the middle of the dividing-wall of the house. The fireplace is in the kitchen. In the room adjoining there is no fireplace, but it is fitted up with a boiler. The grate of the kitchen has attached to its back a box made of malleable iron. Of this box a diagram is here given.

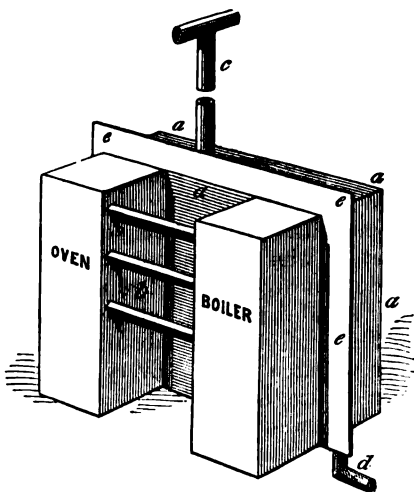
a a a Iron box.

b Grate, having the iron box fastened to its back.

c Iron pipe conducting warm air into the two garrets.

d Earthen pipe brought in from the outside, and carried under the floor into the bottom of the iron box.

e e e Flanges of iron box to be fitted into the grooves in the stone jambs and lintel.



The box is constructed of plates of malleable iron riveted closely together. These plates stand apart from each other 4 inches. It is 3 feet 8 inches wide, and 2 feet high; or rather, it corresponds in size with the back of the kitchen fireplace to which it is attached. This iron box, as will be seen from the diagram, is a chamber containing warm air, and by means of which the two garret bedrooms will be heated; and from the outer side of the plate of the box heat will be given out to the scullery. At the sides and top of this iron box next to the fireplace it has an iron *flange*, 2 inches wide, attached to it. The sides of the fireplace have stone jambs fitted into them, with a stone lintel over them. Into these stone jambs and lintel a groove, 3 inches deep, is cut; into this groove the flanges of the iron box are inserted. A cement composed of sal-ammoniac and iron-filings is used to fill up the grooves after the insertion of the flanges, to prevent the passage of smoke into the adjoining room. At the bottom of the box is a circular hole for the admission of cold air. Into this hole is inserted an earthen pipe, which runs underneath the floor to the outside of the wall. By this pipe the cold air rushes into the box, is soon heated, and, ascending the pipe, distributes the heat over the garret bedrooms, one or both, as required. At the

top of the box there is also a circular hole. This is for the insertion of an iron pipe to convey upwards the heated air into the garret bedrooms. This pipe is made of sheet-iron, and is of sufficient length to pass upwards into the garret rooms. The top of this perpendicular pipe has a short cross-pipe fitted into it; one limb of this cross-pipe enters one garret room, the other the other. Each mouth of this iron pipe has a valve by which the warm air ascending can be admitted or shut out at pleasure.

The back part of the iron box in the fireplace in the kitchen to be covered over with a thin flag of fire-clay to prevent the fire injuring the iron box.

This section of the cottage will show in what way the iron box is affixed to the grate, and how the pipe underneath the floor conveys cold air into the box to be warmed, and shows also the pipe in which the air, when heated, ascends into the two garrets.

While recommending this method of heating a cottage of four rooms with one fire, I cannot refrain from urging on all landed proprietors who may adopt it, to fit up the fireplace with a grate having an oven attached to it. Scarcely a cottage in England, however small it may be, but has an oven. The oven itself adds greatly to the comfort of the labouring man's family. They can bake their own wheaten bread. Every young Englishwoman, before going out into service, is thus taught at home the art of baking. In Scotland it is otherwise; not having the convenience of an oven, the women are wholly unacquainted with the way of making wheaten bread. Every householder, in hiring female servants, knows how difficult it is to find one who can bake. This disadvantage would be removed by the suggestion we have ventured to make. Should the cottage have no garret rooms over those below, one fire might be made to heat both of these two rooms by a very simple contrivance. The cottage fireplace must be placed in the dividing wall of the two rooms. A hole must be left in the wall, of the same size as the fireplace, in the one room, and the space to be filled in with a malleable-iron plate. It is necessary to have two stone jambs, having notches cut in their sides, two inches deep, to receive the sides of the iron-plate; and a stone lintel to cover over the jambs, having also a two-inch notch cut into it, to receive the top of the plate. The sides of the plate, when placed in the jambs and lintel, to be filled with a paste composed of steel-filings and sal-ammoniac. By means of this paste no smoke will escape into the other room. The plate getting heat from the fire in the other room, will throw it off into the next one, and thereby keep it at a warm and comfortable temperature. This plan of heating two rooms on the ground floor, will be found very useful in those parts of the country where fuel is expensive.

AGRICULTURE AT THE MEETING OF THE ASSOCIATION FOR THE PROMOTION OF SOCIAL SCIENCE.

WE would have been much disappointed if, at an assembling of men from various countries, and of all shades of political opinions, met to discuss questions bearing on the social wellbeing of man, the subject of agriculture had not been represented. We were glad to find, on looking over the programme of the week's proceedings, that several papers were to be read which bore both directly and indirectly on agriculture. Thinking that a short *resumé* of the agricultural subjects discussed at the meeting might be both profitable and interesting to the readers of the Journal, we have thrown together the following notes on them.

The President, in his inaugural address, alluded to the extension of "co-operation to the agricultural classes, the most important part of the community." He mentioned some places in England where the system had been introduced with success; but as these were agricultural villages inhabited by labourers who work on the adjoining farms, and as such villages are but of rare occurrence in Scotland, the workpeople generally living on the farms, it is evident that, however well it may work in the agricultural villages of England, it cannot be generally applied to Scotland. But friendly societies, and what are called *ménages*, which are conducted on the co-operative principle, prevail among the agricultural labourers of Scotland, and are worthy of being mentioned here, as they have generally proved most successful. Most of our agricultural labourers are not only themselves members of these societies, but their children are also entered as members almost from their birth. There are two kinds of friendly societies: those in which the members subscribe a certain rate every year, and in the event of sickness receive an allowance per week during their illness, according to the rate subscribed; and those in which the friends of a subscribing member on his death receive a certain sum to defray the funeral expenses, according to the rate subscribed. The former are sometimes called Sick Societies, and the latter are sometimes called Dead Societies. The *ménage* is conducted on a different principle. It lasts only for one year. During the year the members pay a certain rate into the treasury once a-week, or once a-month, as the case may be, and in the event of there being any sickness among the members, an allowance is made according to the rate of their subscriptions. At the end of the year the books are balanced, and after deducting the allowances that may have been paid away to sick members during the year, and any other trivial expenses, the balance is paid over to the members, according to the rates of their subscriptions. The distribution of the funds takes place at one of the terms, when the house-rents are due, and thus the managers of the society may be said to have acted as the bankers of the members for the reception of their

rents by weekly or monthly instalments. We prefer a *ménage* to an ordinary friendly sick or dead society, for various reasons. First, because we believe it has a far greater tendency to foster habits of economy and saving, from the members being obliged to lay past, at stated periods, a part of their wages. We have known members of friendly societies, which collect the money but once a-year, being obliged to borrow money to enable them to pay up their yearly subscriptions, as they had not the forethought to lay past a part of their wages during the year for this purpose; Second, because, when a member removes to a distance from the headquarters of a friendly society, he is very apt to neglect the payment of his subscription, and finds it inconvenient to forward it to the treasurer, and thus the rights of membership are frequently lost. In a *ménage*, on the other hand, which only lasts for a year, the members are only bound for that year; and when they receive their proportion at the end of the year, if it be not required to pay rent, or some other household or family expense, it may be deposited in the savings' bank. We are aware that sometimes *ménages* are differently conducted; the funds collected during the first week, after deducting the usual expenses, are handed over to one member, those of the second week to another member, and so on, each member in his turn receiving a week's subscription. But this plan is not to be commended.

The first subjects relating to agriculture that were discussed at the meeting of the Social Science Association are "Disease in Cattle," and "The System of Inspection in relation to the Traffic in diseased Animals or their Produce." Papers on these subjects were read by Mr Holland and Professor Gamgee. Mr Holland stated that, while previous to 1842 the losses from disease amongst our stock never rose higher than 2 per cent, they reach now frequently 8 and 9 per cent, and in some counties 10 and 11 per cent. He complained of the great want of inspection both of our live stock and of our dead meat, and attributed the prevalence of disease very much to this. As a remedy, he advocated the establishment of an Inspector-General of Live Stock Traffic throughout the United Kingdom. His duties should be to collect reliable information as to the health of stock, whether imported from abroad or circulating in the home trade—to keep himself in communication with the different inspectors of towns, fairs, and markets throughout the country. Mr Gamgee, after some preliminary remarks on the prevalence of infectious diseases, suggests first, that farmers and others should be compelled to notify any outbreak to the nearest recognised cattle-inspector, or to the police; secondly, that the district veterinary inspector should examine stock exposed for sale in fairs; thirdly, that private slaughter-houses should be abolished; fourthly, that the inspection of slaughter-houses should be conducted by a veterinary surgeon; fifthly, that attention should be paid in every important town to the dairies which supply our thronged populations with milk.

Agreeing as we do in the main with both Mr Holland and Professor Gamgee in their statements as regards the prevalence of disease amongst stock, of the great losses from it, and of the necessity of measures being taken to prevent the spread of contagious diseases, and appreciating their services in their endeavours to enlighten the public on the subject, and provide a remedy for the evil, we consider them entitled to the thanks of the agricultural community. We are aware that some parties have been taunted with interested motives for carrying on the agitation against the sale of diseased animals and diseased meat. But surely no one will accuse Mr Holland of interested motives. He is an extensive proprietor, and is largely engaged in agricultural pursuits; but he is well known as a man of great public spirit, and as a member of Parliament he is always ready to support any measure that can tend to the benefit of agriculture. He is only interested as a proprietor and farmer in having his stock protected from contagious diseases, and as a member of the community, in being saved from purchasing diseased meat. Surely, great as is the boon of his being protected from purchasing diseased meat, and his stock from disease, his personal exertions and anxieties on behalf of the community are more than a recompense. While we do not attribute interested motives to Mr Gamgee, we must say that there are grounds for these taunts, and that he has laid himself open to them by the schemes he advocates. His constantly insisting on none but veterinary surgeons being appointed as inspectors at slaughter-houses, at public markets, and in different districts throughout the country; his advocacy of a system to "provide livings" for those of his own profession, so that the number of them might be increased,—are quite sufficient for those differing from him in opinion to taunt him with interested motives, however pure his may be. But Mr Gamgee must, amidst these taunts, console himself with the motto of the poet—"Mens sibi conscia recti." But while we agree with these gentlemen in their estimate of the amount of disease, and of the spread of contagious diseases, we do not approve at present of the remedial measures proposed by them. We believe that the evil can be cured by a much less expensive machinery than that proposed by them. And we protest against farmers being compelled to notify to an inspector any outbreak of a contagious disease amongst his stock. His being compelled to do so supposes that a penalty will be inflicted if he does not do it. Many farmers may have such a disease raging among their stock without being aware of its nature, and yet, by his not informing the inspector, he may render himself liable to the penalty. And if the inspector be not the veterinary surgeon whom he usually employs, the services of another will be forced upon him. It should further be enacted, that if any animal labouring under a contagious or other disease be slaughtered by the orders of the inspector, the owner shall receive its full value. We quite agree with them, that

all animals sent to fairs and markets should be inspected before being allowed to enter the market-stances; but these precautions would be quite futile were railway companies permitted to transport sound and diseased animals without cleaning and washing thoroughly the trucks immediately after every lot of beasts has been removed. It is as necessary to inspect stock before being sent by railway or steamer as before entering a market-stance.

The discussion which followed the reading of these papers turned very much on the question as to whether diseases resulted in the human subject from the eating of diseased meat. Those who spoke were very much divided in opinion on the subject, and, upon the whole, we thought that the meeting desiderated more proof as to the consumption of diseased meat engendering disease in man. One fact was alluded to during the discussion, which we have also seen stated in a paper by Mr Simon, medical officer to the Privy Council, and it is this, that "our animal food, before we take it, has for the most part been exposed to so high a temperature, that any parasites which had their home in it are killed, and whatever albuminous morbid contagion it contained has been coagulated and made inert." It is also worthy of notice, that, notwithstanding all that has been said of the increase in the consumption of diseased meat, the general health of the community is improved, and longevity is increased. We are inclined to think that Professor Gamgee and others are riding their hobby of diseased meat too hard, and the effect will be that ere long many people will be put from consuming both sound and unsound meat by the disgusting descriptions of diseased meat which appear from time to time in the public prints. Some weeks since we were engaged in the consumption of a beefsteak in the western metropolis, when our eye fell on a letter by a V.S. in a newspaper. We read it, and found it to consist of minute revolting descriptions of five or six cases of diseased cattle which had been dosed and drugged before being sent to the slaughter-houses, where their flesh was passed as food for the inhabitants. We finished the perusal of the letter, and attempted to finish our steak, but in vain. "Waiter! a glass of brandy!—Quick!" We entered the house hungry, we left it sick, and for two days our digestive organs were out of order.

Another important subject relating to agriculture, which was fully discussed at the meetings of the Association, was that of Emigration. It formed an important part of Sir John M'Neil's presidential inaugural address. He limited his remarks to emigration from the north-western Highlands and Islands. He showed the condition of this particular district of Scotland, and the means of subsistence in them. Crofters and cottars everywhere constitute the great mass of the population. The crofters hold a small piece of land from the proprietor at an average rent of £4, 4s. 1d. in one district, the produce of which is only capable of providing his family with food

for six months. For subsistence for the other six months, clothing and other expenses, he is entirely dependent upon his labour, unconnected with the cultivation of his croft. "It is a misapprehension," says Sir John, "to regard them as a class of small farmers, who are expected or supposed to get their living and to pay their rents from the produce of their crofts. They are truly labourers, living chiefly by the wages of labour, and holding lots for which they pay rent, not from the produce of the land, but from wages." The cottars and crofters cannot obtain employment in their own district, and consequently they go to the south or any quarter where they can find work during the summer and autumn. And having gathered a little money, they return to their homes, where they spend the winter in idleness, their means of subsistence being derived from the produce of their crofts and the wages which they had saved, till the spring comes, when they prepare their land for the crop, sow the seed, and, having done this, emigrate again for work. It is not difficult to understand how we are startled every other year by cries of distress from the famishing population of these districts. The failure of their crops, or of their fishing, is equivalent to the loss of their livelihood for one-half of the year. Sir John M'Neil wisely suggests, as a remedy for this evil, emigration from a country where employment cannot be obtained, and where they are always living on the brink of starvation, to one where there is abundance of employment and no lack of food. Most of the other speakers on this subject advocated the same views as Sir John, showing the benefits of education both to those who leave home, and to those who are left at home. Dr Begg alone did not think that this country was overpeopled; he thought that there should be some public interposition between the landlords and the right of clearing whole districts of country, and devoting them to deer and other purposes. He maintained that the best policy was, to multiply our industrial population at home. Where the country has been cleared for sheep and deer, the former population of human beings could not subsist; and is it not better to have thriving flocks of sheep and herds of deer on the same ground on which formerly half-starved men lived, but who have fortunately been removed from the miseries of starvation to a land of plenty? We can scarcely believe that Dr Begg, Mr Bright, and others who hold the same views, are so blind to the difficulties of the proprietors in these districts as they appear to be. We have sometimes wished them in the place of some of these proprietors, surrounded with their difficulties. Suppose that Dr Begg or Mr Bright purchased a property in the Western Islands, being induced to do so by the promise of a large return for his money—say 5 per cent.—and, with what would please either of these gentlemen, a large population of crofters and cottars. Of course such philanthropic gentlemen will do all they can for the comfort of these people. They will build them new houses, with three rooms in each

—Dr Begg at least will do this ; they consider it the best policy to multiply the industrial population at home, and therefore they set about improving the estate so as to give employment to the people. They drain, they plant, they make roads, they build, till in the course of four or five years they have improved all the estate, and spent their spare cash, which was probably equal to the purchase-money of the estate. So far all has gone on merrily. They look now for a return from their purchase and their improvements, and expect the crofters to pay their rents without their being asked for them. But they look in vain ! Even in an ordinary year the crofters tell them that, as all the improvements were done, and they had no employment, they could not only not pay their rents, but that they could not see how they were to be preserved from starvation for one half year. These gentlemen paid them hitherto wages for work done, now they are compelled to dole out charity to them to keep them from starvation. This goes on for a few years, till the proprietors themselves are reduced almost to starvation, and while in this extremity a lowland farmer comes forward and offers them a rent of some hundreds if they would allow their estate to be converted into a sheep-farm, and prevail upon and assist the crofters and cottars to emigrate. We doubt much if the Rev. Doctor and Mr Bright would not see a new light in things, and take a commercial view of matters. They would at once see the great advantage of emigration to the crofters, but not to themselves ! Oh no ! they never think of themselves, if the industrial population, which they think should be multiplied at home, can be made happy in a foreign land ! The circumstances we have detailed regarding this property are not hypothetical. They have actually occurred on an estate purchased by an acquaintance of our own, with this exception, that he did not run short of cash, and is quite independent of any income from this property, and therefore he has not converted his estate into a sheep-farm.

The opportunities Sir John McNeil has had of inquiring into this subject, and the attention he has devoted to it in connection with his official duties as Chairman of the Board of Supervision, give his opinion an importance above that of any other person in the kingdom ; and none is better qualified to express that opinion. He traced the evil of over-population to its source ; he contrasted the condition of those parishes where the remedy was applied with that of others in which it was not applied. " The assimilation of the condition of those parishes," he said, " to that of the more advanced parts of the country which had previously undergone a somewhat analogous change, proceeded rapidly ; no cry of distress now comes from them." And he hints that any other course adopted than that proposed by him would prove unsuccessful. " It is probable that every attempt at improvement in a direction opposed to the progress of assimilation will be unsuccessful, and there is reason to

fear that it may subject the people involved in it to another process of painful transition." Though nothing we can say can add to the weight of Sir John's opinion, yet we cannot refrain expressing our hearty concurrence with his views. From observations we have made in the Western Highlands, and an extensive intercourse we have had both with the proprietors and tenants there, we have come to the conclusion, that the best plan to pursue for landlord, tenant, and labourer, and for the district, is to supply the means of emigrating to the superabundant population, to throw the crofts into farms of good size, to reduce the quantity of land under the plough, and to improve the pastures for cattle and sheep. We say for cattle, for the specimens of West Highland cattle we saw, where proper attention was bestowed on them, led us to the belief that breeding cattle would pay as well as breeding sheep in that moist climate, and that too at very little additional expense for winter fodder; for the winters being mild there, the cattle can lie out the greater part of them. The proposal to maintain the population to its present numbers by retaining the croft and introducing an improved system of cultivation, is as unsound in political economy as it would be inexpedient and unprofitable in practice, and proves that the advocates of such a plan have but little practical acquaintance with the subject. Crofts can only be recommended on an estate, and that but to a limited extent, as adjuncts to the large farms. The maintaining the croft system even under an improved system of cultivation in the Western Islands, where a good harvest is an exception, would be only to render the people more miserable, and, as Sir John M'Neil says, "to subject them to another process of painful transition."

Three important papers were read, the first on the "Laws relating to the Purchase of Land," or laws in reference to land viewed as a subject of commerce, by Lord Curriehill; the second on the "Torrens System of Conveyancing by Registration of Titles, as in operation in Australia, and applicable to Ireland," by Mr Torrens, Registrar-General of South Australia; and the third on the "Extension of the Landed Estates Court, completed by the Registration of Title, to Scotland, and of the Montgomery Act to Ireland," by Mr Dix Hutton. We mention these papers here, more with the view of recommending them as worthy of an attentive perusal, for the subjects treated of in them are too important to be commented on in the limited space we can devote to them in this article. The sound reforms of a practical nature suggested by Lord Curriehill would, if carried out, be of immense advantage in simplifying the laws relating to the purchase of land, and bringing it within the scope of a marketable subject. At the conclusion of his paper he gave a calculation of the land in the British foreign possessions still unalienated. He stated this to amount to 1500,000,000 of acres, besides groups of colonies in the West Indies, Ceylon, on the coast of Africa, and elsewhere. Why should we have starving Highlanders at home,

when we have such a vast extent of land in our colonies inviting settlers, and which, Lord Curriehill tells us, can be purchased for about 2s. 6d., rising to and seldom exceeding £1 per acre? The Torrens system commends itself to us by its great simplicity. Registration is the principle, the sum and substance of it; and the title obtained is as secure as the mode of obtaining it is simple. Such a system is what is very much wanted in Scotland, instead of the cumbrous and expensive one in practice at present. Mr Torrens showed how easily and cheaply a man could borrow £10, or any smaller sum, or larger, on the security of his land. Such a system would facilitate the introduction of land debentures, at present recommended by several parties in Scotland. Mr Hutton's paper was devoted to illustrating and proving the great advantage of introducing the Torrens system into Scotland and Ireland. An interesting discussion followed the reading of these papers, the lawyers offering a good many technical objections to the introduction of the system into the legal procedure as regards the conveyance of land in Scotland and Ireland. Lord Curriehill, in summing up the discussion, stated that "the discussion which had taken place just showed that the old difficulty which affected all questions of jurisprudence arose here—the conflict between abstract justice on the one hand, and expediency on the other." Lord Brougham bore testimony to the admirable manner in which the Incumbered Estates Act of 1849 had worked in Ireland; "it well merited being extended in some such way as Mr Torrens's plan proposed."

Agricultural labourers and their dwellings received a fair share of attention at the meeting—Mr Robb, Mr Scott Skirving, Dr Begg, and others advancing the opinions which they have expressed elsewhere. We do not think that either party has made the slightest impression on the views of his opponent regarding the cottage and bothy system. The cottage accommodation necessary for the agricultural labourer and his family is estimated at from two rooms and a closet to four rooms. We quite agree with Mr Robb that there should be a recess for a bed in the kitchen; but we confess that we see no use for the parlour advocated by him. A parlour and kitchen suppose two fires constantly on during the winter months in this climate, and we fear that most labourers would grudge, if they could afford, this expense of firing. The moderate views advocated by Mr Robb, and supported by some of the ablest and most intelligent tenants in Scotland, should make his opponents consider whether it would not be better to endeavour to have the condition of the bothies improved till cottages can be gradually substituted for them. For it must be borne in mind that a change from the bothy to the cottage system must be accompanied by a change in the habits of the people. But we do hope that the time is not far distant when there shall be a large increase of cottages in the northern counties, where the bothy system prevails. As usual, during the discussion some

extraordinary statements were made regarding the cost of building cottages—one gentleman, for instance, asserting that cottages with two rooms and a closet can be built for from £44 to £50 each. As the size of the rooms and the building materials of the cottages are not mentioned, we can only express our doubts as to the correctness of the statement.

Dr Begg read a paper "On the Necessity of appointing Public Inspectors for Rural Cottages." He gave, as a reason for this necessity, the little that had been done in improving the dwellings of the rural labourers. Now, we appeal to any unprejudiced observer, if a great deal has not been done in building and repairing the dwellings of the Scotch agricultural labourers during the last few years, and particularly since that meeting on the subject was held in Edinburgh about the beginning of the year 1861. The wonder is that so much has been done when we take everything into consideration—such as almost all of the farm cottages in Scotland being under lease, and consequently in a great measure out of the power of the proprietors, and the inability of many entailed proprietors to do anything under the present law of entail. If the Rev. Doctor had made a movement to have the proprietors relieved of these disabilities, no one could have blamed him: on the contrary, most would have admitted that he had laid the working-classes under an additional debt of gratitude for his exertions in their interest. But Dr Begg could not allow the opportunity to pass of holding up the proprietors to reprobation, whether they deserved it or not. There are some people who, if we may judge from their speeches and their writings, seem to think that the proprietors can do no good, and the tenants and labourers can do no harm—the faults of the former are exposed and magnified, and any good they do is sedulously concealed; while the faults of the latter are glossed over, and their good actions blazed forth. This is the second time in this paper we have had to allude to Dr Begg's appeal to the law and the civil power against the proprietors of Scotland. This frequent appeal to the civil power by a divine in the nineteenth century is very apt to carry our thoughts back to the thirteenth and fifteenth centuries, and to remind us of the spirit of Dominick, of Torquemada, and of Ximenes. As we protested against any arbitrary enactments being made against the property of tenants through the influence of Mr Holland and Mr Gamgee, we protest now against similar measures being taken against the property of landlords through the influence of Dr Begg.

Discussions on other subjects affecting agriculture—such as the sewerage question—also took place, but as nothing of practical importance, or which has not frequently been treated of in this Journal, was elicited, we pass on at once to offer a few comments on the two papers more directly bearing on agriculture—viz., that of Mr Hope, Fentonbarns, "On the Conditions of Agricultural Success," and

that by Mr M'Lagan, of Pumpherston, "On Agriculture as a Commercial Pursuit." There is much in these two papers in which the writers agree, and there are a few things in which they differ. We shall offer a few remarks first on those subjects on which there is little, if any, difference of opinion; second, on those parts of Mr Hope's paper to which Mr M'Lagan does not allude; third, on those parts of Mr M'Lagan's paper to which Mr Hope does not allude; and then on those subjects on which they differ. The first point, then, on which they agree is on the necessity of having leases. These they insist on as being absolutely necessary for the successful carrying on of agriculture as a commercial pursuit. They also both agree as to the desirability of a change in the landlord's right of hypothec, and more particularly that part of it which gives him the right of following "grain bought at a fair price by sample in the open market, and compelling the buyer to pay twice for the same article." This is a right both these gentlemen maintain no landlord should possess. We believe that it would be better for landlords were the law abolished, and the plan of fore-rents proposed by Mr M'Lagan substituted; but we suspect that this arrangement would not be found to work so well for tenants in bad seasons, for, as the landlord's security terminated with the rent-day, he would not be inclined to give the tenant indulgence which many landlords now give when their security is maintained for some months after the rent-day. On the question of the game-laws they are almost agreed. Mr Hope thinks that their harshness might be modified, or they might be abolished; Mr M'Lagan proposes that every tenant should be allowed to kill game on his farm. The extraordinary length to which the preservation of game is carried on some estates nowadays, the wholesale slaughter which takes place among them at battues, and the injustice in binding the tenant to support so much game without compensation, calls loudly for some modification of the law. For the sake of the tenant, we would willingly have it abolished; but unless some more stringent law of trespass were enacted than that now in use, we fear that the abolition of the game-laws would be a greater boon to the reckless poachers than to any other members of the community. Both landlords and tenants would be more annoyed than ever by them.

We come now to offer a very few remarks on those parts of Mr Hope's paper to which Mr M'Lagan does not allude. And, first, Mr Hope advocates the abolition of the laws of primogeniture, because these laws retard agricultural success and progress. We are surprised that, in expressing this opinion, Mr Hope should have forgot the state of agriculture in France, where the law of primogeniture is abolished. It is unfortunate for his argument that in Britain, where this law is strictest, agriculture is in a more advanced state than in any other country in the world, while there are few countries in which agriculture is more backward than in France,

where the law does not exist. Mr Hope also objects to any one who leaves property to advocate opinions or found charities. As we understand him, he would have a law prohibiting this. Of course, this applies to any other kind of property as well as to land. The hospital or charity properties with which we are acquainted are as well managed as any private landed estate; but we confess we cannot understand how this subject was introduced in a paper "On the Conditions of Agricultural Success." We are quite willing to enter at length on the subject in its proper place, when perhaps it would be found that we are at one with Mr Hope; but we forbear expressing our opinion on it here as being out of place.

Mr M'Lagan showed, in the commencement of his paper, that the letting of a farm was clearly a commercial transaction, and that the landlord should be guided in the selection of his tenant, not merely by the amount of rent offered, but by his skill, capital, and fitness for the particular farm for which he offers, all of which should influence his choice in the carrying out of this commercial transaction. The lease should also be drawn up as strictly as any legal paper can be made. But as many vicissitudes might occur during a twenty-one years' lease, he counsels a liberal interpretation of the clauses of the lease, and a mutual forbearance on the part of landlord and tenant. Mr M'Lagan, after insisting upon permanent improvements being performed by the landlord, alluded to the practice now prevalent of proprietors borrowing money from Lands Improvement Companies, and getting their tenants to agree to pay the whole of the interest—viz., $6\frac{1}{2}$ per cent. He showed the injustice of this, and objected to Government giving special privileges to these companies before other capitalists in the country. They obtained the money from Insurance Companies, and charged the proprietors commission for lending it to them. He also alluded to the advantage of proprietors being allowed to issue debentures on their estates, not only to themselves, but to the capitalist and the community at large. We could have wished, did our space admit, to enlarge on this part of Mr M'Lagan's paper, but as other more important parts deserve some remarks from us, we shall only say at present that the Torrens system of registration, to which we alluded in a previous part of this article, offers facilities for carrying out this proposition of Mr M'Lagan's. There are at present many small and large owners of capital who are desirous of investing their money in heritable securities, and there are many proprietors who wish to borrow small sums of money for a few years, but the expense of doing this deters them from it. With the Torrens system a proprietor could issue debentures for £100 each, or for any other amount, more or less, payable in a certain number of years; and these might be made transferable and marketable. Mr M'Lagan then remarked upon the amount of capital required for stocking the farm, and the profits derived from farming. It will, no doubt, sur-

prise many to hear that, to farm properly, requires a capital of from £10 to £12 per acre, while the average capital for Scotland is not estimated at more than £5 per acre. And thus we see it requires from £5 to £7 per acre—and we do not think that Mr M'Lagan is wrong in his estimate—to bring the agriculture of Scotland up to what it should be. As regards the profits of farming, but few make the 15 per cent on capital which Mr M'Lagan says a farmer is entitled to get. The want of capital prevents many a one from realising the full profits of farming.

The author of the essay then touches on an important subject, which is exciting a great deal of interest at present—viz, the reduction of the land under the plough, and the increase of that in grass. After showing that the price of wheat is about the same now as it was ninety years ago, while butcher-meat has risen about 100 per cent and wool 150 per cent, he advises farmers to restrict their land under the plough and increase their grass. These figures show that the present relative prices of butcher-meat and grain are not temporary; but that, while the one has been gradually rising for the last ninety years, the other has been stationary. And we do not see any prospect of a rise in the price of grain and a fall in that of meat, for so long as bread is low in price people will have more money to purchase butcher-meat. In the main we agree with Mr M'Lagan. In all those districts blessed with a good soil and climate, and in those favourably situated near towns, where there is a ready market for their produce, we would not advise any great change, though we think it would be as profitable for those not near the markets to put some more of their land into grass. But we have no hesitation in saying, that in a great part of Scotland at an elevation say of about 400 feet and upwards above the level of the sea, and about twelve miles inland from the east coast right through to the west coast, where soil and climate are indifferent, and harvests precarious, not more than one-half of them during a lease being counted on as good,—we repeat, we have no hesitation in saying that there is in these districts far too much land under the plough to be profitable. Let any farmer there turn up his books, and he will find that his profits from stock have been swallowed up by his losses in grain and root cultivation. In these districts, it must be remembered that besides the great drawback of bad harvests, there is more expense for labour and manure than in the more favoured districts; and as both labour and manure are tending to rise in price, produce is falling, so that cultivation there is becoming ruinous. The expense of labour, then, must be reduced, and this can only be done by reducing the cultivation. But we will be met by the objection, If you reduce the cultivation how can you get winter food for your animals? We shall proceed, then, to answer this objection. In the highest parts of these districts there is much under the plough which ought never to have been

turned up, excepting for renewing the grass : it will be far more profitable to throw it into pasture and keep sheep, manuring and cutting some of the grass every year for hay for winter keep. If the soil is light and gravelly, on which a crop of turnips can be cheaply grown, a few may be raised for the sheep in winter, and the land sown down without a crop. If the land is a thin clay that won't keep grass, as is said, so much of it, if the grass fail, may be turned up after being drained, manured, and sown with rape and grass-seeds without any corn-crop ; or if a corn-crop can be risked, two corn-crops may be taken, after being well manured, and grass-seeds sown with the second ; but on no account should the land of this description be injured by taking a turnip crop. This may be considered heterodox, but there is no doubt it is the best system. We have seen a field managed according to the most approved system of husbandry—a crop of oats, then turnips, well manured, then oats with grass seeds taken from it. We have seen a beautiful braird of grass the first year indifferent pasture the second, and scarcely anything else but weeds in the field the third year. We have seen a field of similar soil on the other side of the road ploughed up, two white crops, manured with bones and guano, taken in succession, and sown down again, and we have seen much better grass on it, and the grass remaining longer, than on the former field. We have seen, by judicious management of the pasture, by eating cake on it, and manuring it with nitrogenous and phosphatic manures, good grass remain on it for years without being turned up. Surely it is much better to devote a part of this grass in those very high-lying districts to hay for winter keep, than entering into all the expenses of cultivation for the half-ripened oats and half-rotten straw which is usually obtained there.

But where the elevation is not so great, a little more cultivation may be risked, but only as much as is necessary to supply winter keep for cattle. In this part of the district, say from about 350 to 500 or 560 feet above the sea, the usual breadth of grass is two-fifths, and nearly three-fifths under the plough. Now, we maintain that this is far more than is necessary, with good management, to keep the usual stock in winter. The land might be made to lie three or four years in grass ; and to enable the land to keep grass the manure that would have been applied to it when under the plough could be applied to the grass, and, if need be, cake could be given, and there would be no fear of the grass being thrown out. The true reason of the grass not remaining in the land is the want of its proper food there ; give it that food, and there is no fear but that grass will remain there. If the soil is friable, turnips may be grown on it to as great an extent as is necessary for the stock ; if, however, the soil is a thin clay, as mentioned above, restrict the growth of them to a small extent ; perhaps it will be found as profitable not to grow any turnips on the farm excepting in such fields adapted to

their growth. It must never be forgot that every ton of turnips costs 7s. or 8s., and as cheap substitutes can be purchased ; for instance, we can winter stock much cheaper on rape-cake than we can on turnips, and the animals be in as good condition. It is also found much more profitable not to give the large quantities of turnips to fattening stock as used to be done ; and, therefore, the breadth of turnips may be reasonably restricted on such a farm as we are describing, and the expense of labour materially reduced. We may mention, also, that hogs are now wintered cheaper and better on locust beans and rape-cake than they can be on turnips. But what is to be done for the want of straw if you reduce the extent in white crop? We at once reply, that it does not follow that we reduce the quantity of straw in proportion to the reduction in the extent of land in white crop. The liberal treatment we recommend for the grass would enrich the soil, and give much larger white crops ; but we do calculate upon reducing the quantity of straw upon the whole, and the advice we give is just to economise it. There is a great deal of straw thrown into the dung-heap at present that might have been most profitably used either for litter or fodder ; economise the straw, we say, and use more hay, which can easily be got from so much land being in grass. Let there be no open courts for cattle and no boxes, or, if boxes are used, let them be floored like Mr Mechi's, and, if there is any fear of reducing the stock from want of straw, dispense with it for litter in the byres, and use mats, like Mr Telfer. It is surprising what shifts a man will make if he is put to it ; and if he finds that his stock is paying him so well, and that he is losing money by his grain, he will soon devise means for increasing the number of the former and paying proper attention to them, and for reducing the extent of the latter. We have thus shown that, by having more grass, and the liberal treatment of it, more stock can be kept in summer, and at least as many, if not more, can be kept also in winter, if the money laid out in unnecessary cultivation be more profitably employed in the purchase of cakes and other foods ; and if the farmer, on turning up his books, again finds that the paying part of his farm—viz., his stock—has been increased, and the losing part—viz., his cultivated portion—decreased, he must admit that Mr M'Lagan has given no bad advice, to reduce the extent of land under cultivation and increase that under grass. We are aware that the advice is given by some to "plough more that we may graze more." Plough more ! Let the Cumberland farmers answer :—Mr Jefferson stated that, "If he had never ploughed a single furrow when he took his farm, eighteen years ago, he should have been richer. He could get more profit out of a pair of Irish cows' jaws than he could get out of an acre of wheat." This was the general tone of the speeches at the dinner of Cumberland farmers near Carlisle, invited to meet Mr Mechi. What is true of Cumberland is true of Scotland also, "Plough more that

you may graze more ! " that is, " Increase your expenses and you will reduce your grazing profits." No ! It should be rather, Manure, more ! Manure your pastures more, both with special manures and with feeding with cake, &c., and then you will be able to graze more, and by grazing more you will be able to raise more crop from less land, and thus reduce the expense of ploughing more.

The only subject on which Mr M'Lagan and Mr Hope differ materially, is that of compensation for unexhausted improvements, or "tenant-right." Mr Hope thinks that there should be a clause in every lease allowing compensation for unexhausted improvements. Mr M'Lagan, on the other hand, thinks that such a clause is quite unnecessary in a properly drawn-up lease, which is quite sufficient to meet all the requirements of progressive agriculture. Believing, as we do, that a lease which is "based on equity," and "explicit in its stipulations," is sufficient for the conducting of agriculture as a commercial pursuit, for imparting justice to the landlord, the outgoing and incoming tenant—that the insertion of such a clause as that proposed by Mr Hope would only clog the working of a good lease, and tend to inflict injustice on one or other of the parties, and observing that, where tenant-right prevails, it has only been adopted as a clumsy substitute for a lease—we heartily concur with Mr M'Lagan in his views. A farmer of experience and judgment, who proposes to take a farm on a lease, feeling that he has a security for his capital, considers and calculates what amount of capital it will require ; and, knowing that he must not look for the landlord or incoming tenant restoring any to him at the end of his lease, lays it out judiciously, and farms in such a way as that his capital, and something more, may be returned to him if he leave the farm at the end of his lease. A farmer, on the other hand, who rents a farm on the tenant-right system, trusting to the sum which he will receive on leaving his farm, is reckless and careless in his management, and farms too often rather with the view of having a large sum paid him if he leave his farm, whether he be entitled to it or not, than with the object of having the largest return for his capital from the soil. Hence we find that in Scotland, where leases prevail, farming is in a more progressive state, and rents are higher, than in any other country in the world ; while in those parts of England where tenant-right prevails, agriculture is almost, without exception, in a backward state. We are as anxious as Mr Hope can be that a spirited tenant should be amply remunerated for his skill and energy, and in cases of extraordinary improvements performed by him, that he should get the full benefit of them ; and to enable him to do this, the lease can be lengthened out. We would also propose that, where a tenant erected buildings without the consent of the landlord, he should be at liberty to remove them, if the landlord does not take them at a fair valuation, on the condition that he does not injure the landlord's property by their removal. Mr Hope says—

"It would be easy to appoint competent persons to estimate the state of cultivation and manurial condition of a farm, and upon the terms of the report made by them, payment would be made by the landlord to the tenant, or by the tenant to the landlord, as the farm was improved or deteriorated."

Of course the same parties would require to value the farm at the beginning as well as at the end of the lease. But great changes take place in nineteen or twenty-one years, and the men who valued the farm at the beginning might be dead or have left the country before the end of the lease. We have seen too much of the shifts to which outgoing tenants resort to raise the sum to be paid to them when any little things are referred to arbitration. We have seen roads scraped and stackyards raked, which had not undergone these operations for nineteen years before, and mud and wet and blackened straw thrown into the dung-heaps, to be valued at the stereotyped price of 4s. or 6s. per yard; we have seen too much of these shifts to agree to incoming tenants being compelled to submit to the haphazard guesses of arbiters on additional subjects, as proposed by Mr Hope. We object, further, to an incoming tenant being compelled to pay for the unexhausted value of any or every manure the outgoing tenant might choose to apply, or for the manurial value of any kind of cake he might choose to use the year before. It was not with such a spirit the late Mr Brodie of Amisfield Mains and Abbey Mains farmed—a man perhaps not equalled, and certainly not surpassed, as a farmer by any of his own profession in the same county of East Lothian. We remember that, after the farm of Amisfield Mains had been let to another in preference to himself, he continued to farm it in the same generous manner as he had always done. He manured his turnips as liberally, and gave the sheep on them cake in the last year of his lease. On some of his friends remarking to him that he would lose all the manurial value of the cake, his answer was, that he was better paid by farming thus generously, than if he had stinted his land of manure, and his sheep of nourishing food; and that he did not grudge to his successor what he was leaving behind.

A great weight of authority is opposed to Mr Hope. It is evident that he has been considering the case of the outgoing tenant, as most are apt to do who are already in farms, without taking the case of an incoming tenant into account. Here is what Mr Wilson, Edington Mains, says on this subject, alluding to the injurious plan of deteriorating a farm at the end of a lease:—

"There is at present a very generally entertained opinion, that this inconvenience would be obviated by engrafting the system of tenant-right upon that of leases. A proposal to this effect would probably be well entertained by the holders of existing leases, but we believe that it would be anything but popular with incoming tenants. The view of this matter is confirmed by the experience which we have of the effects of having the straw and dung produced on farms *steel-bow*—that is, the property of the landlord, and transferred by him, free of charge, to entering tenants, on condition that they

leave them so to their successors. This arrangement is generally admitted to be better for all parties, than when away-going tenants have a 'right' to claim payment for these commodities from their successors, or to sell them off the farm if they prefer to do so. Scottish experience is therefore unfavourable to the system of tenant-right in the only instance of it which obtains there."

Mr M'Lagan quoted the opinion of Mr Caird and Mr M'Culloch as opposed to "tenant-right;" but his quotations would not lead the reader to suppose that these gentlemen's opinions were so strong and decided as their writings upon the whole indicate. Mr M'Culloch, for instance, in his 'Treatise on Political Economy,' says :

"The recognition of any claim to the value of unexhausted improvements would be most mischievous, and is, indeed, quite at variance with the principle of occupancy for specified terms. Tenants holding under leases for such terms are anxious to undertake all necessary works with the least possible delay, that they may derive from them the largest amount of profit. But if they could make a charge at the close of their leases for unexhausted improvements, it would be comparatively indifferent to them when they began operations, and the undertakings most indispensable might be indefinitely deferred. Although, however, these results should not follow, as they would necessarily do from the introduction of this practice, it would give rise to others of a still worse description. The occupancy and improvement of land would be associated with all sorts of frauds and abuses; shams would be substituted for realities, and skilful impostors would fatten on pretended improvements. How is the value of what is called an unexhausted improvement to be ascertained? It is obvious that no fixed rule or standard can be appealed to in deciding upon such questions. They must be left to arbitration. And, considering how impracticable it is to ascertain anything of their real value, with the ignorance and the biases of those who would have to be taken for arbiters, full scope would be given to every variety of jobbing and trickery. Every one who knows anything of the valuations effected in England, though in general they comprise only the values of ploughings, standing crops, and collections of manure, must wish for their suppression. They are, in truth, a mere tissue of abuses."

So much for Mr M'Culloch: now for Mr Caird, whose opinion is the more valuable, as he admits that he has changed his views on the question of tenant-right after observing its practical working. He says:—

"The practical value of tenant-right has led us to the conviction (contrary, we admit, to our preconceived opinions), that it is not desirable to extend it, either legally or conventionally, to other parts of the kingdom. However well it may look in theory, we should find the honest and intelligent farmers of other counties becoming disgusted with its frauds, and, as the same class are now doing in Surrey, North Notts, and the West Riding, demanding its restriction, and recommending their landlords to buy it up and get rid of it."

We quote the following from Caird's 'English Agriculture' again, to show that "tenant-right" does not lead to good farming, as some allege:—

"In no other part of Yorkshire but the West Riding have we met with the custom of 'tenant-right;' and we have not the slightest hesitation in saying, that any dispassionate observer who will compare the state of farming in that part where it exists with the general average farming of the East and North Ridings, where it never has existed, will at once

affirm that it has not produced a better style of farming. And we are assured by an extensive farmer of much experience in the West Riding, who has himself had to pay this tenant-right, and is therefore familiar with its operation, that it leads to frauds of every kind ; which, in truth, cease to be counted frauds, inasmuch as the party who suffered at his entry feels himself justified in retaliating on his successor. Instances have been known of tollmen being bribed to sign for false quantities of manure as having passed through their bar ; and it is quite common to secure the services of a valuator, not according to his character for skill and justice, but mainly in reference to his skill in getting up and carrying through a 'good' valuation. In what other branch of business would such a blundering system be tolerated ? The best farmers are now desirous of having certain points restricted, and believe that it would be a benefit to their class if the landlords would purchase up and put an end to many of its vexatious exactions. We repeat, that to whatever other consequences this custom may lead, whether to landlord or tenant, it has not in the southern division of the West Riding conduced to superior farming."

We quote again, from the same work of Mr Caird, what he says of tenant-right in Lincolnshire, which is sometimes adduced as evidence of the favourable working of tenant-right :—

"The evidence of claims for manure purchased, and for cake, &c., consists of the dealers' receipts for these articles, which are sometimes fraudulent, especially when the outgoing tenant has another farm in his possession. On the whole, however, the system is believed to have worked well ; though the landlords are beginning to find the claims of the outgoing tenants so serious, that, in order to check their increase, they prefer embodying their claims in a special agreement, to trusting to the indefinite custom of the country. The Lincolnshire system, as at present in operation, has not led to the frauds practised in Surrey and Sussex ; partly, perhaps, because it has not been so long a period in use. But an indefinite custom of this kind is liable to great abuse, and it must possess advantages of no common kind to compensate this risk. In a large district of country where it is most literally observed, we did not find the farmers one whit less desponding than in other places where they had no such security ; and they were limiting their outlays and complaining of their landlord's quite as much as in Essex or Suffolk. The best farmers we had an opportunity of visiting are still behind the agricultural proficiency of the leading men of West Norfolk, whose capital is protected by a twelve years' lease and a liberal landlord ; and there is a vast extent of land in Lincolnshire in a very backward state, and where much has yet to be done by both landlord and tenant. Nor do the farmers themselves attribute so much benefit to the system of tenant-right ; as compensation for unexhausted improvements, however valuable in itself, is, in their opinion, of less importance to the progress of agriculture than moderate rents, and the existence of perfect confidence between good landlords and good tenants."

Our reason for bringing these lengthened extracts before our readers is, to let them have the opinions of those gentlemen who have had abundant opportunities of judging of the working of the system of tenant-right. We have seen that it conduces to bad farming, and leads to frauds, and those who have had some experience of it appear to be desirous of a change. With such experience before them, let Scotch farmers beware of having the tenant-right system engrafted upon that of their leases, which hitherto has worked so well.

AGRICULTURAL SUMMARY FOR THE QUARTER.

WE are glad to be able to report that the past year has been a great deal more favourable for farmers than the two preceding ones. Prices, indeed, have remained extremely low—lower than ever, in fact; but a very full crop has enabled farmers to bear this better than a small crop with higher prices. Indeed, there is little probability, unless a European war befall us, that corn will ever reach a much higher value than that at which it stands at present, and farmers must trust to raising heavier crops rather than to an advance in the market. Fortunately, the lowness at which wheat is now sold in the market is not due to large imports from abroad, but to an unusually good yield at home, the crop in most cases having turned out even better than the most sanguine anticipated. There is a great difference in the imports of foreign corn in the first ten months of the current year and the corresponding period of last. Up to the end of October 1862 we had imported no less than 7,751,301 qrs. of wheat; in the same period of this year we only received 4,802,872 qrs. There was an almost equal decline in the imports of flour this year as compared with last, the quantity received being only 4,291,943 cwts., as against 6,468,804 cwts. in 1862. Adding the wheat and wheat-flour together, we find that the imports are less in the ten months of this year by 3,570,317 qrs. The money values are as yet officially made up only to the end of September. At that time last year we had laid out upon wheat and flour the enormous sum of £20,930,192; in the first three quarters of this year our outlay on the same commodities amounted to only £11,651,286, or £9,278,906 less. On barley, oats, pease, beans, and Indian-corn, however, our expenses are heavier this year by £1,961,723, so that the difference in saving this year effected by our splendid crop is £7,317,183—a very comfortable sum indeed, and one which the three last months of the year are likely to augment considerably. As with the cereal crops, so with the potatoes and turnips, which have yielded remarkably well—far beyond early expectations. In the case of the former, indeed, it may be doubted whether there ever before was such a full crop raised. We have heard of instances of 100 bolls to the Scotch acre, and data were supplied that left no room to doubt that this almost incredible yield was in strict accordance with fact. Notwithstanding such magnificent crops, however, a great many farmers, on account of previous bad years, have had to succumb to the evil fortune which even this good year could not enable them to resist. One scarcely ever takes up the ‘Gazette’ now without finding there the name of one or more farmers who, a few years ago, were deemed well off. This indicates how severe the pressure of the last two or three seasons has been, and how much we ought to be grateful that

Providence this year favoured us with a bountiful harvest. With so many "going to the wall," one is afraid to speculate what would have been the consequences of another bad year to corn-growing farmers.

The weather has been unusually mild for the season. Indeed, we scarcely remember a winter quarter with so few wintry characteristics about it. Up to the 20th of the month, we can scarcely be said to have had any frost; we have had only two or three showers of snow, neither heavy nor lasting; and the average rainfall, though we have had one or two heavy floods, has been small, especially in the latter part of the quarter. The consequence is that farm work in all districts is remarkably well forward. The autumn wheat has been generally got in in prime condition, and is coming above ground in a manner that promises well for next year. So far as can be judged, there is much about an average quantity sown. Under the mild forcing temperature the grasses retain a freshness quite uncommon at this period of the year, and still afford a good bite for cattle. The turnips also continue to increase in size even up to the middle of December. We should now, however, be nothing the worse of the ameliorating action of a little frost. The mildness which has been so favourable to vegetation, has had a most prejudicial effect upon the human subject, and an unusual number of cases of illness and death, chiefly from fevers of a typhoid nature, have occurred.

Stock (leaving out of the question the murrain, which has been very prevalent, though perhaps not quite so severe as we sometimes have it) has on the whole been healthy, and has been realising very high prices. The original cost of store cattle, however, has been so high that the feeder has been less in pocket than might be supposed from the high price of butcher-meat. Mutton and wool have been paying uncommonly well, and farmers are talking about altering their rotations in order that they may have more of their land in pasture. There can be no doubt at all that the stock and sheep farmers have of late years been enjoying a prosperity which arable farmers may be excused for looking on with envy; and there does seem room for the latter to devote more attention to raising and grazing animals on their farms. At the same time, caution should be exercised in making a change; and the grass on arable farms should, perhaps, be looked for less from a large area of land laid down than from a small one well treated with manurial dressings, and kept still further in heart by giving the cattle and sheep thereon cake and other artificial feeding substances. As yet, however, though much has been said about restricting the area of wheat-land, we do not observe, as a rule, that much has been done. But in the western part of Scotland, where the rainfall is heavy, we believe it would greatly advantage the farmer to give the plough less to do.

Agricultural Societies.—After harvest-time agricultural societies become as active in the club-room, as for a few weeks before they were active in the field—in discussing questions of farming practice

and interest. The *Boroughbridge Agricultural Society* had an interesting but not quite definite discussion as to the best means of "converting straw into manure." The opinion of the introducer of the subject is, that fattening animals for the butcher are the producers of the best manure; "for to make an animal fat for the butcher at a profit, it must be done as quickly as possible; and in order to accomplish that object, it must be amply supplied with rich flesh-forming food; and as an animal, when almost fat, only extracts from the food a small proportion of the nitrogenous matters contained, it follows that the remainder will be ejected from the system, so that the nearer maturity an animal is the richer will be the manure." In order to feed animals to the best advantage, it is necessary that the feeder should determine what are the most nutritive kinds of food, and what proportions to give them so as to secure the greatest possible good with the least possible waste. Every farmer must of course find this out for himself, as each is influenced more or less by locality. But the following table from the '*Bath and West of England's Journal*,' as to the meat-producing qualities of certain kinds of food, will be of use to all:—

Number of Pounds Weight of each Article required to make One Pound of Beef.

	lb.		lb.
Barley,	6	Linseed-cake and pease, equal	
Oats,	7	quantities,	4½
Beans,	8	Clover hay,	12
Pease,	8	Swedes,	150
Rape-cake,	6	Mangold,	150
Cotton-cake,	6	Carrots,	150
Linseed-cake,	5 or 6		

Of course, where farms are not adapted for feeding cattle for the butcher, the farmer must depend upon his horses, sheep, and pigs as manure-makers; and by paying attention to the food of these animals, and by seeing that the manure is sheltered, it may be made far more valuable as a fertiliser than it otherwise would be. But this must be left to individual judgment; at all events, the *Boroughbridge Society* did not lay down any practical and universally-applicable rule for the guidance of farmers. Before the *Winfirth Farmers' Club*, Mr Duncan of Dorchester read a paper on "Corn Averages," showing how loose the method was of obtaining them, and how comparatively worthless they were as representing the true price of the article, the returns often not reaching a third part of the quantity that was grown in the country. He suggested that steps should be taken to bring the matter before Parliament, with a view to obtain legislative sanction for a more effective method of securing fuller and more accurate returns. The *Badenoch and Rothiemurchus Society* have been discussing the propriety of directing their attention most to corn-growing or stock-raising. As a general rule, the

opinions of the members were in favour of sheep-farming, but there were not wanting those who maintained that, although Badenoch was so far above the sea-level, arable farming would still pay there so long as they could get 20s. a-quarter for oats; and when they could not get so much, it would even pay to cultivate the land in order to give the corn to the bullocks. One thing against arable farming in this district is the want of proper drainage; but, even with that, it may well be doubted whether corn-growing would ever be as profitable to farmers here as cattle and sheep feeding. At the annual meeting of the *Inverness Farmers' Society*, "The best Preparation of Land for a Grass Crop" was discussed; the reason for taking up this subject apparently being a general belief among the members that with beef and mutton and wool at their present prices, and cereals so low, it would be necessary to reduce the extent of arable land and increase that in grass. It was not to be expected that there could be a general agreement as to the method of laying down grass, as practice must vary in different districts, according to the nature of the soil, subsoil, and climate. All were agreed, however, that in laying down grass crops the land should be thoroughly cleaned and manured, and that the seeds themselves should be carefully selected. Some recommended trench-ploughing, with liming; while others had found that turning up the subsoil had been attended with the most injurious effects, while liming did not appear to have done much good. In most cases it will, perhaps, be safest for a farmer entering a new place to be guided in such cases, to some extent, by the general practice of his neighbours, who have had longer experience of the district. At the *Nairnshire Farming Society's* meeting, "The Application of Lime to the Land" was discussed, and a general recommendation was given that dung should be used with lime. Where land had been over-limed, trench-ploughing was advised. Mr Anderson of Lochdu, a very successful farmer, said, "His whole experience went to make him prefer the practice of giving a light liming first, and then continuing it every green crop, especially where the land was light. Weighty land, such as that in Morayshire, would take double what their light land in Nairnshire would. The great thing was to give plenty of dung, and there was not much fear of over-liming. Many a time land was said to be over-limed when poverty was the ailment; and, if they gave lime along with plenty of dung, there was no fear of getting good crops of all kinds." Before the *Fettercairn Farmers' Club* a most interesting paper on "The Grub" was read by Mr Scroggie, Auchcairnie. As the ravages of this most destructive creature are as extensive as arable farming in Scotland, and as farmers have tried almost endless remedies in vain, they will, we are sure, thank us for quoting the following recommendation by Mr Scroggie, which is based upon a large number of carefully-collected and well-authenticated facts:—

"From all the information I have been able to gather, the best way of securing our crops from the wholesale destruction with which they are now threatened is not in the variety and quantity of top-dressings, but in the preparation of the soil for the seed. This appears to be best accomplished—first, by burying the surface of the lea, and then by consolidating the ground. In other words, bury the eggs, to exclude them from the necessary essentials for farther development—viz., air, heat, and light—and then consolidate the land, to prevent any newly-hatched, and consequently feeble, insects from burrowing in search of food. The question naturally arises, How are these two operations to be most successfully carried out? First, then, as to the disposal of the eggs. Several methods might be adopted with advantage. We have already proof of the benefit of skin-coulters attached to ploughs, which peel off the tough surface, and by the aid of chains and weights deposit it in the bottom of the furrow. It is thus completely covered up by the mould-board with six or more inches of soil. On stony land, of course, that would be impracticable. In such cases a light furrow might be taken by one or a pair of horses, and a deeper one by another pair following in the same track. The feet of the furrow-horse of the last plough would injure the eggs to some extent; at all events, although rather a severe task for the horse to walk on the soft earth, it would tend to firm the lower part of the furrow, which, by the use of high-cutting ploughs, is left in a very loose state—the beautiful surface being now more admired than the close packing of the furrows. The same end is thus obtained, but at double the expense of the skin-coulter. If ploughs were made for the purpose, one horse would be sufficient to clear the surface. I suggested a new kind of implement to a practical farmer as well as an eminent implement-maker, and, as he was of opinion that it would answer the desired purpose, I will venture to give you a description of it. Let a frame be made the breadth of five furrows. On one side fix the working part of two miniature ploughs, each sufficiently strong to take up from the surface of the lea a slice of 3 or 4 inches in breadth and from $1\frac{1}{2}$ to 2 inches in depth, and place it on the undisturbed portion of the surface. On the other side put two rollers for pressing, rather more of a semicircle on the edge than those now in use. After this implement has passed over the land, let two common ploughs follow; and the grassy surface being placed on the edge next the furrow, it will be deposited in the bottom. The presser again coming round will seal it into its position. Harrowing might be tried previous to sowing. It has succeeded in one instance, and would at all events prevent the loss of seed between the furrows. It might be argued that on many kinds of soil the seed could not be covered with such an amount of preparation; but let us learn from the past season. The seed in many instances of second sowing was well covered, after repeated rolling. Is it not better to leave a portion of the corn to the fowls of the air rather than bury it, to pamper in the first stages of life an insect which, if encouraged, will not hesitate to devour the whole produce of your fields? Such a practice might lead to the use of heavier harrows. The light wooden things nowadays are barely worthy of the name. They scratch and level the surface, it is true, but they do not pulverise the soil and break down the lea furrow as they ought, so as to provide tender food for plants. Lastly, a clod-crusher could be passed over the land before sowing, and a heavy roller immediately thereafter. I have said little about the use of a presser; but I have no doubt, if that implement was flattened on the edge, and not made of a wedge-like shape, as at present, as if intended to prevent the furrows from joining together, it might be applied with advantage on all soils. It has failed alone to prevent the ravages of grub in this district; but, aided by the use of other implements in preparing the soil, it would doubtless prove a valuable assistant."

The *East Lothian Farmers' Club* have had before them the question of steam cultivation, about which Mr Sadler, Ferrygate, and Mr Hope, Fenton Barns, who are both possessed of steam implements, expressed themselves in very favourable terms. Mr Sadler, who has now had his in use for more than a year, was able to report, from actual experiment, that his crop of potatoes after steam culture was about 25 per cent more than after horse operations; and Mr Hope had nothing but good to say of it, so far as his experience went. Mr Begbie, Queenston Bank, had he been present, would have been able to make a like flattering statement as to the advantages of steam in the field. Since that meeting, Mr Reid, Drem, has purchased a steam-cultivating apparatus, so that there are now four in East Lothian, and all on farms nearly adjoining. Mr Sadler has Fowler's method; so also has Mr Begbie. Mr Hope has preferred Howard's, and Mr Reid has chosen Coleman's, so that any who are interested can now, within a couple of hours' walk from Drem station on the North British line, see three different systems at work. At the *Morayshire Farmers' Club*, Mr Geddes, Orbliston, read an interesting practical paper "On the Profits from a Breeding Stock of Sheep in Morayshire." He took a farm of 200 acres, which he stocked with 120 ewes, 156 lambs, and 2 Leicester tups, at a total cost of £364. The sheep, it may be mentioned, are half and three-parts bred. We cannot go into the details of the treatment, which will be found reported at length in the agricultural newspapers; but we may state that Mr Geddes reckons the profit realised from such a flock, after deducting interest on original capital at 5 per cent, and expenses of bathing and shepherd, to be £274, 10s. 3d., which is certainly not at all bad. The *Central Farmers' Club* have discussed "Agriculture in Relation to the Veterinary Art," and also "Stock-Breeding on Arable Farms." Down in Ayrshire, Professor Anderson has been lecturing on the appropriate subject for that district of "Dairy Farming;" and the same gentleman has, in the course of the quarter, addressed the members of the Highland and Agricultural Society on the "Rotation of Crops." Before the Social Science Meeting in Edinburgh we had two interesting papers from Mr Hope, Fenton Barns, and Mr M'Lagan, of Pumpherstoun, on general agricultural topics; and a paper was read by Mr Robb on the vexed question of "Hinds' Houses and Bothies."

English Fat Shows.—These shows continue to grow in interest and importance. This year the great exhibitions at Birmingham and London, where the prizes amount in each case to upwards of £2000, were more than usually well filled with animals in the various classes; and, as a whole, they may be considered better than ever they were before, though showing no one animal equal to some we have seen in former years. Last year it was a cross-bred animal that carried off the champion prize in both yards; this year the pure breeds have been once more set up in the place of honour, a shorthorn

getting first in Birmingham, and a Hereford at London, where the Birmingham prize shorthorn also got a medal as the best female animal in the show. Our Scotch breeders, as usual, stood remarkably well at these exhibitions.

The Royal Agricultural Society of England holds its annual meeting this year at Newcastle-upon-Tyne, and as an inducement for Scotch breeders to come across the Border they offer extremely liberal prizes. For Ayrshire Scotch polled and Scotch horned they offer no less than £110 in each class. The prizes are £20 and £10 for the best and second-best bull calved before January 1863, and £20 and £10 for the best and second-best calved after that date; £15 and £5 for the best and second-best cow; £10 and £5 for the best and second-best heifer calved before January 1863, and the like sums for heifers calved after that date. The divisions and prizes are the same in all three breeds. For Clydesdale horses the Royal also offers £110, divided as follows—viz., £20 and £10 for the best and second-best stallions foaled before January 1862; £15 and £10 for the best and second-best foaled in 1862; £20 and £10 for the best and second-best mare and foal; and £15 and £10 for the best and second-best two-year-old fillies. For Cheviot and black-faced sheep £110 is offered, £55 for each. The total sum thus voted for Scotch breeds specially by the Royal Agricultural Society of England is £550. In addition, we have a prize of £30 offered for a swing-plough. We make no doubt that Scotch breeders will show their appreciation of the liberality of the Royal by forwarding largely their best stock.

Double-Cropping Experiments.—An account of some double-cropping experiments by an intelligent farmer, Mr Rintoul, East Craigie, near Cramond, has appeared in the agricultural papers. Nowadays, when, under the high rent of farms and the low price of cereal produce, it becomes incumbent on every farmer to neglect no opportunity of making the most out of his land, any hint that will enable him to do so will no doubt be received with gratitude. We therefore make bold to quote the following, but our readers must judge for themselves how far it can be made applicable in their own circumstances:—

“Mr Rintoul commenced his system of double cropping by taking turnips after early potatoes. The potatoes sown about the end of February were manured with 40 tons of farmyard dung and 5 cwts. of Peruvian guano to the Scotch acre. About the last week of June these potatoes were raised, and the land as speedily as possible got into condition for the turnip crop, which was sown about the beginning of July, 5 cwts. of Peruvian guano per Scotch acre being given. Year after year Mr Rintoul has continued this plan with success, eating the turnips off with sheep, and the white crops following have generally been excellent. As an example of how little this practice exhausts the land under the liberal treatment it receives at East Craigie, we may mention that this year Mr Rintoul took 12 qrs. of barley per Scotch acre from a field which in the previous year had been cropped with potatoes, and turnips fed off with sheep. All that it received, in addition to the

manuring for the two preceding crops, was a top-dressing of 1 cwt. of nitrate per acre when the braird was hoed. The field was seeded at the rate of 2 bushels per Scotch acre.

"This year, Mr Rintoul determined to carry his system of double cropping a step further, to take a crop of potatoes after potatoes—that is, a second crop from the same land in one year. Like a cautious experimenter, Mr Rintoul did not risk too much at first, and set aside only an acre or so for the trial. The first crop of potatoes, a good one, was lifted on the 22d June. The land was immediately got into order, and the second crop was planted on the 26th, four days after the first was taken off the ground, 5 cwts. of Peruvian guano being given them. The weather became excessively dry after the tubers were planted, and remained so for about six weeks. Mr Rintoul trembled for the result of his experiment; but, notwithstanding the untoward circumstances under which it was conducted, it has turned out most successful. He calculates that the yield will reach at least 25 bolls per acre, and the potatoes are of very fair size, and excellent to eat. At present they resemble new potatoes in flavour. Next year Mr Rintoul contemplates raising at least as many potatoes as a second crop as will seed his farm. The turnips which were this year sown after potatoes are now looking remarkably healthy, with a profusion of shaws and capital bulbs. Indeed, we have seen fields this year where the turnips, as a first and only crop, did not equal in appearance those now to be seen at East Craigie."

AVERAGE PRICE OF THE DIFFERENT KINDS OF GRAIN,

PER IMPERIAL QUARTER, SOLD AT THE FOLLOWING PLACES.

LONDON.								EDINBURGH.							
Date.	Wheat.	Barley.	Oats.	Rye.	Pease.	Beans.		Date.	Wheat.	Barley.	Oats.	Pease.	Beans.		
1863.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	1863.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
Sept. 5.	46 8	35 6	22 6	32 0	36 8	36 9		Sept. 2.	41 4	31 8	20 7	42 6	43 3		
12.	45 9	36 10	21 4	34 0	48 0	37 8		9.	43 8	33 6	26 7	41 6	42 0		
19.	47 0	39 0	18 6	33 6	39 8	38 10		16.	42 0	32 10	25 8	44 2	45 0		
26.	47 9	36 6	20 6	30 0	49 7	37 0		23.	41 6	31 8	24 8	38 9	40 6		
Oct. 3.	45 4	37 8	21 8	32 11	42 10	37 0		30.	42 0	30 6	23 2	44 6	45 1		
10.	44 0	37 3	20 0	32 7	39 4	35 2		Oct. 7.	41 0	30 4	23 5	38 7	39 2		
17.	44 4	36 5	20 4	33 6	37 8	38 1		14.	40 11	29 6	21 1	40 0	40 6		
24.	45 0	34 8	20 6	30 4	42 5	34 9		21.	40 8	28 11	21 2	41 2	41 8		
31.	43 9	34 7	18 11	30 10	38 9	34 7		28.	41 5	28 10	20 8	35 0	36 2		
Nov. 7.	45 2	36 2	18 9	31 0	35 10	34 6		Nov. 4.	39 1	29 3	20 5	35 1	36 0		
14.	44 1	34 0	19 9	31 4	34 0	31 0		11.	38 4	30 3	20 3	35 7	36 4		
21.	45 7	35 10	21 8	31 0	34 5	35 5		18.	38 0	29 11	20 5	36 5	36 8		
28.	46 1	33 7	21 7	30 8	36 6	35 11		25.	39 7	29 11	19 11	37 1	37 6		

LIVERPOOL.								DUBLIN.							
Date.	Wheat.	Barley.	Oats.	Rye.	Pease.	Beans.		Date.	Wheat.	Barley.	Oats.	Flour.			
	p. barl.	p. barl.	p. barl.	p. barl.	p. barl.	p. barl.			20 st.	16 st.	17 st.	14 st.	p. barl.	9 st.	
1863.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	1863.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
Sept. 5.	44 8	32 6	20 0	30 8	35 10	37 6		Sept. 4.	28 1	16 6	14 10	14 0	19 7		
12.	46 1	32 2	20 9	30 6	35 4	37 10		11.	27 10	16 4	14 8	13 10	19 6		
19.	42 1	31 9	24 10	30 4	35 2	37 4		18.	27 7	16 6	14 6	13 8	19 5		
26.	40 10	32 8	21 9	29 9	35 10	37 8		25.	27 4	16 2	14 7	13 6	19 7		
Oct. 3.	41 0	33 2	24 4	29 6	36 2	38 2		Oct. 2.	27 6	15 10	14 4	13 4	19 6		
10.	38 5	32 6	25 9	28 4	36 0	37 10		9.	27 10	15 8	14 6	13 6	19 8		
17.	40 3	32 2	21 10	28 6	35 8	37 6		16.	27 5	15 6	14 3	13 8	19 4		
24.	37 8	32 10	20 0	27 6	34 6	37 4		23.	27 2	15 10	14 1	13 6	19 2		
31.	38 5	33 2	21 0	26 6	33 9	37 0		30.	26 8	15 9	13 10	13 2	18 10		
Nov. 7.	37 1	32 8	18 8	25 5	34 1	36 8		Nov. 2.	26 10	15 8	14 1	13 8	18 8		
14.	38 9	31 10	20 10	26 2	33 8	33 1		9.	27 2	15 6	14 0	13 6	18 10		
21.	37 2	32 1	19 2	26 6	33 6	34 4		16.	26 9	15 8	14 2	13 4	18 6		
28.	39 2	31 6	17 8	29 9	33 2	34 10		23.	26 6	16 0	14 0	13 1	18 4		

TABLE SHOWING THE WEEKLY AVERAGE PRICE OF GRAIN,

Made up in terms of 7th and 8th Geo. IV., c. 58, and 9th and 10th Vict., c. 22. On and after 1st February 1849, the Duty payable on FOREIGN CORN imported is 1s. per quarter, and on Flour or Meal $4\frac{1}{2}$ d. for every cwt.

Date.	Wheat.		Barley.		Oats.		Rye.		Pease.		Beans.	
	Weekly Average.	Aggregate Average.	Weekly Average.	Aggregate Average.	Weekly Average.	Aggregate Average.	Weekly Average.	Aggregate Average.	Weekly Average.	Aggregate Average.	Weekly Average.	Aggregate Average.
1863.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
Sept. 5.	44 2	45 9	34 8	32 3	22 0	22 10	32 11	34 3	37 2	35 8	38 10	39 5
12.	44 1	45 5	34 7	32 10	21 8	22 8	31 0	33 1	35 10	35 8	39 10	39 8
19.	44 9	45 2	35 2	33 5	20 9	22 3	32 7	33 4	36 9	35 11	39 0	39 8
26.	43 9	44 10	35 9	34 2	20 12	21 9	32 1	32 7	37 5	36 3	38 11	39 5
Oct. 3.	42 2	44 1	35 4	34 11	19 8	21 2	31 0	32 8	36 7	36 7	37 11	39 0
10.	41 0	43 4	34 7	35 0	19 4	20 7	31 5	31 10	36 4	36 8	37 10	38 7
17.	40 4	42 8	34 0	34 11	18 8	20 1	29 2	31 1	34 7	36 3	36 5	38 12
24.	40 0	42 0	33 11	34 9	18 7	19 7	28 9	30 8	35 8	36 3	36 6	37 7
31.	41 2	39 10	34 0	34 7	18 11	19 3	28 0	29 11	35 2	36 0	35 8	37 1
Nov. 7.	40 6	40 7	34 2	34 4	18 7	19 6	28 0	29 5	35 0	35 7	35 10	36 6
14.	39 10	40 2	34 0	34 1	18 9	18 10	25 0	28 5	34 1	35 2	36 5	36 3
21.	39 11	40 9	33 11	34 0	19 11	18 11	29 7	28 1	34 2	34 9	35 6	36 0
28.	40 8	40 6	33 7	33 11	19 7	19 1	34 9	29 1	34 1	34 8	36 1	36 0

FOREIGN MARKETS.—PER IMPERIAL QUARTER, FREE ON BOARD.

Date.	Markets.	Wheat.				Barley.				Oats.				Rye.				Pease.				Beans.			
		s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.
1863.																									
Sept. ..	Danzig	24	6	30	0	14	6	20	6	11	6	14	6	18	0	21	6	25	0	29	0	28	0	30	0
Oct. ..		22	4	28	6	14	0	30	0	11	0	14	0	18	6	22	0	24	6	28	6	25	0	29	6
Nov. ..		22	0	27	6	13	6	18	6	11	0	14	0	17	6	20	0	24	0	28	0	24	0	28	0
Sept. ..	Ham- burg	25	0	29	6	15	0	20	6	11	6	15	0	18	6	22	0	26	0	30	0	25	6	30	0
Oct. ..		23	6	28	0	14	6	18	6	11	0	14	0	17	7	30	6	25	0	28	6	25	0	29	6
Nov. ..		22	6	27	6	14	0	17	6	10	6	14	0	16	6	20	6	24	6	27	6	24	0	28	0
Sept. ..	Bremen	24	6	29	6	15	6	20	0	12	6	14	0	18	0	21	6	25	0	28	6	26	0	30	6
Oct. ..		22	6	28	0	14	6	18	6	12	0	13	0	17	6	20	6	24	6	28	0	25	0	28	0
Nov. ..		21	6	27	6	14	0	17	6	11	6	13	0	16	6	20	0	24	0	27	6	24	0	27	0
Sept. ..	Königs- berg	25	6	30	0	15	0	20	6	12	6	15	0	18	0	22	0	24	0	30	0	25	0	29	6
Oct. ..		24	6	29	0	14	6	19	6	11	6	14	0	17	6	21	6	23	0	28	6	24	6	28	0
Nov. ..		23	6	28	6	14	0	18	6	11	0	14	0	17	0	20	6	23	0	28	6	24	0	27	6

Freights from the Baltic, from 5s. to 7s. 6d.; from the Mediterranean, from 10s. to 11s. 6d.; and by steamer from Hamburg, from 5s. to 5s. per imperial qr.

THE REVENUE.—FROM 1ST JULY 1863 TO 30TH SEPTEMBER 1863.

	Quarters ending Sept. 30.		Increase.	Decrease.	Years ending Sept. 30.		Increase.	Decrease.
	1862.	1863.			1862.	1863.		
	£	£	£	£	£	£	£	£
Customs	6,201,000	5,872,000	..	329,000	23,863,000	23,771,000	..	92,000
Excise	3,604,000	3,922,000	318,000	..	17,430,000	16,992,000	..	438,000
Stamps	2,180,000	2,191,000	11,000	..	8,824,945	9,146,000	321,055	..
Taxes	166,000	176,000	10,000	..	3,160,000	3,193,000	33,000	..
Post-Office ..	895,000	905,000	10,000	..	3,560,000	3,760,000	200,000	..
Miscellaneous	580,983	479,504	..	102,479	2,315,595	3,027,382	701,787	..
Property-Tax	974,000	866,000	..	108,000	10,532,000	10,605,000	73,000	..
Total Income	14,600,983	14,411,504	349,000	539,479	69,685,540	70,494,382	1,328,842	530,000
Deduct increase .....	..	..	..	349,000	Deduct decrease .....	..	530,000	..
Decrease on the qr. ...	..	..	..	190,479	Increase on the year	..	798,842	..

PRICES OF BUTCHER-MEAT.—PER STONE OF 14 POUNDS.

Date.	LONDON.		LIVERPOOL.		NEWCASTLE.		EDINBURGH.		GLASGOW.	
	Beef.	Mutton.	Beef.	Mutton.	Beef.	Mutton.	Beef.	Mutton.	Beef.	Mutton.
1863.	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.
Sept. ..	7 9 - 8 9	8 3 - 9 3	7 6 - 8 6	7 9 - 8 9	7 6 - 8 6	8 0 - 9 0	8 0 - 9 0	8 3 - 9 3	8 3 - 9 0	8 6 - 9 6
Oct. ..	7 9 - 8 9	8 3 - 9 3	7 6 - 8 6	7 9 - 8 9	7 9 - 8 9	8 3 - 9 3	8 3 - 9 0	8 6 - 9 6	8 3 - 9 0	8 6 - 9 6
Nov. ..	8 0 - 9 0	8 6 - 9 6	7 9 - 8 9	8 0 - 9 0	8 0 - 9 0	8 3 - 9 3	8 3 - 9 0	8 6 - 9 6	8 6 - 9 3	8 9 - 9 9

PRICES OF ENGLISH AND SCOTCH WOOLS.—PER STONE OF 14 POUNDS.

ENGLISH.		s. d.	s. d.	SCOTCH.		s. d.	s. d.
Merino, .....	..	23	0	Leicester Hogg, .....	..	26	0
.. in grease, .....	..	18	0	.. Ewe and Hogg, .....	..	21	6
South-Down, .....	..	24	0	Cheviot, white, .....	..	21	6
Half-Bred, .....	..	18	0	.. laid, washed, .....	..	16	0
Leicester Hogg, .....	..	25	0	.. .. unwashed, .....	..	12	0
.. Ewe and Hogg, .....	..	21	0	Moor, white, .....	..	11	6
Locks, .....	..	12	0	.. laid, washed, .....	..	10	0
Moor, .....	..	9	0	.. .. unwashed, .....	..	8	0

A BIRD'S-EYE VIEW OF EAST LoTHIAN.

THE county of East Lothian not being altogether a *terra incognita* to the readers of this Journal, it would be superfluous to give any minute description of its characteristics and leading features, and its general system of agriculture is too well known to require any detailed notice.

In the diverting and perhaps salutary rivalry which, from generation to generation, one county quietly carries on with its neighbours, East Lothian has nothing to boast of in point of size, and indeed its want of *bigness* would inevitably earn for it the contempt of a Yankee.

Nearly oval in shape, one side girdled in by the chain of the Lammermoors, and the other encircled by the sea, its length from east to west does not exceed 25 miles, whilst its greatest width is not more than 17; thus comprising an area of about 280 miles, of which extent a little more than 100,000 acres are arable. The population, which at the beginning of the century just touched 30,000, had only increased to 37,000 at the date of the recent census. Of its three royal burghs, two, at least, are as unprogressive, and maintain as Boeotian a repose as generally falls to the lot of agricultural communities. The ancient burgh of Haddington can boast of its venerable cathedral, its busy corn-market, and recently of a weekly mart for the sale by auction of cattle and sheep; but when its inhabitants are not assembled at one or other of these places, their time is chiefly spent in discussing the subject of bad smells—sanitary reform being constantly agitated; but, for all that, it may be said of the town that “it never is, but always to be *drained*.” Dunbar occupies itself in fishing, and *fighting*, if we are to credit a local chronicler in the county newspaper, who states that it is impossible for three Dunbarites, from the bailies downwards, to meet without a row. North Berwick, the third of the civic sisterhood, has, since the branch of the railway reached her, become by far the gayest of the trio. It is true, her sombre sisters may toss their heads and say that in winter she is only a grub, but in summer she certainly disports herself like a butterfly. She has found a mine of wealth in the sands of the sea, and spreads out her parasols and distends her crinolines to the glitter of the sunshine and the sparkle of the waves. Streets, crescents, and villas are rising up, stately hotels built, and fair shrines dedicated to the memory of St Baldred.

We have already noticed the comparative smallness of East Lothian, but nevertheless it comprises within its narrow limits several differences of climate, and almost every variety of soil, from the bald and barren summits and heath-clad sides of the Lammermoors, to the rich alluvial fields that border on the coast, to which, throughout its whole extent, the shire gently inclines, sloping from

south to north. One minor ridge of rising ground, stretching from west to east, and culminating above Haddington in the interesting group called the Garleton Hills, divides the centre of East Lothian into what may be called its landward and seaward aspects; whilst the well-known conic form of North Berwick Law springs up like the horn on the nose of the rhinoceros, and towers sentinel-like over land and sea at the northern extremity of the county.

East Lothian is watered, and in a great measure drained, by its single slowly-flowing river, the Tyne, which, with its little affluents, traverses its centre. It is undoubtedly one of the driest districts in the whole island, and it is frequently remarked by farmers that the lower half of the county would be materially benefited by a larger rainfall. This observation does not apply to the more elevated track verging towards the Lammermoors; but in the low lands grass and hay are often stunted, and spring-sown corn frequently "brairds" irregularly, and turnip-seed often lies long dormant in the ground, which is dried up by east winds and unmoistened by a shower. The average annual amount of rainfall in East Lothian has been stated at 22 inches; but this has been exceeded during the last three years, when the rain-gauge at Thurston, near Dunbar, has marked 25.80, 30.40, and 25.80 for 1861-2-3. Several of the eastern counties of England show an amount of rainfall considerably less than this; but the general average of the United Kingdom is much in excess of it, being for the same years 44.44, 43.67, and 44.37. The vast difference in the amount of rainfall in the east and west coasts of Scotland is strikingly shown by contrasting the amount registered at Dunbar with those of Portree in the Isle of Skye, which for the last three years was 139.04, 111.19, 148.89.*

This comparative absence of rain, of course, mainly arises from geographical position, increased by thorough-draining; but an addi-

* A paper upon the British rainfall in 1863, recently contributed to the 'Times' by Mr G. J. Symons, gives much interesting detail upon this subject. From the returns there given, it appears that East Lothian is nearly on a par with the eastern division of England, and is drier than the eastern portion of Ireland; but, contrary to general opinion, the amount of rain over the whole of Scotland is in excess of that which falls in Ireland. The following is an abstract of the returns:—

	1861.	1862.	1863.
England—Western Stations, . . .	35.49	38.78	35.99
Scotland " . . .	80.40	76.34	83.55
Ireland " . . .	60.95	53.72	59.76
England—Eastern Stations, . . .	22.64	24.78	21.58
Scotland " . . .	30.92	29.52	30.45
Ireland " . . .	36.24	38.86	34.88
England—Entire Kingdom, . . .	29.06	31.78	28.78
Scotland " . . .	55.66	52.93	55.00
Ireland " . . .	48.60	46.29	47.82
United Kingdom, . . .	44.44	43.67	44.37

tional reason may perhaps be found in the cruel, and, as it seems to us, unwise persecution to which trees, and indeed every green thing other than crops, have been ruthlessly subjected. Belts of plantation are in various ways beneficial to agriculture, and hedge-row trees will never lessen the rental of land, but their wholesale destruction will diminish the fee-simple value of an estate in the eyes of a purchaser.

The man who plants an ornamental tree is a public benefactor; he who cuts one down is a selfish clown, who robs the community of a graceful pleasure, which, though he is incapable of appreciating it, money cannot buy.

East Lothian is entirely dependent on its agriculture, its manufactures being almost absolutely *nil*. The linen and woollen manufactures which we read of as having occupied a portion of the people at the beginning of the century, have long since disappeared. An iron-work, started on a considerable scale by two enterprising farmers, has for some time past extinguished its fires; and even whisky, that immediate offspring—or must we say, illegitimate daughter?—of agriculture, which once, at various distilleries, filled many a goodly cask, has been finally expelled from the county by Providence and the Poor's Board of Haddington; but East Lothian can still boast, in Prestonpans table-beer, of the best beverage, at the price, which the world is able to supply.

The only wealth of the county not derived from the fertility of its soil is to be found in its minerals, particularly lime and coal, the latter of which underlies a large portion of its western extremity, affording its inhabitants an unfailing supply of cheap and excellent fuel. The coal in East Lothian was first worked near Tranent, by the monks of Newbattle, about the year 1213; and traces of the mechanical contrivances used by the workmen in former times to assist their labours are frequently met with by the miners at the present day. It is fortunate that, owing chiefly to the absence of destructive gases, the East Lothian pits have been entirely free from any of those catastrophes which so frequently occur in many of the coal districts of the country; and those far-seeing patriots who allow their imaginations to be disturbed by fears that coal may be worked out, and our posterity, some thousand years hence, left without that great necessary of life, may be glad to know that the coal deposits of Tranent are practically inexhaustible.

One more minor occupation of the people may be mentioned—the fishery of the Firth of Forth. A considerable number of men in the sea-coast towns and villages subsist, with their families, by their lines and nets. Like all other people, they have a grievance; and though it may be presumptuous to express an opinion contrary to that of so many grave *savans*, we are inclined to think it is a real one. They say they are ruined by the Edinburgh trawlers. Fish, they say, have almost disappeared from the old fishing-banks

near the shore, because the trawlers, who profess to fish the deep sea only, have nevertheless invaded and destroyed the shallows. It is quite a mistake, say the learned Commissioners ; but it is difficult, for all that, to see how a great rake, dragging up the entire crustacea of the bottom, and carrying spawn, and the home of spawn, to be trampled on the deck, and then tossed back into the sea, is not likely to injure the breeding-grounds. Last summer the fishermen of North Berwick were accused of doing a little bit of the wild justice of revenge after the Milesian fashion. The tackle of a trawler that had put into the harbour was cut to pieces during the night ; and the lord of the manor, who, as a shareholder as well as a magistrate, wished to discover the perpetrators, hit upon the plan of declaring he would prevent the fishermen drying their nets on their accustomed ground, unless they discovered the delinquents. All who know the character of fishermen, and their *esprit de corps*, need not be told that the attempt ended in failure. Whatever be the truth as to the innocence or the injury of trawling, it is a curious fact, that oyster-beds are benefited by a certain amount of dredging, and, if too thoroughly preserved, the oysters disappear. One portion of the famous oyster-ground at Prestonpans has suffered from this unusual cause of injury. It would seem that oysters, like seeds, are the better of a little harrowing to make them grow. The Prestonpans oyster-fishing in general is, however, menaced by a much worse and more active evil than that of too much repose. Vast numbers of minutely small oysters are now being fished up, packed in barrels, and sold for a few shillings to foreigners, who regularly sow them in the mouth of the Elbe and other favourable situations, there to grow and fatten till ready for the mouths of the gourmands. This traffic may soon slay the goose that has long laid such golden eggs.

In talking of the fishery of the Firth, one cannot forget that annual aquatic harvest, the herring-drawe. No ichthyologist has yet given us any satisfactory history of the herring, though it is now known that the old idea of a migration to the frozen seas of the North Pole, and a sojourn under the ice, is a mistake. The fish, no doubt, retire to deep water when they leave our coasts. It is at Dunbar that fish and fishermen most do congregate ; and there, men, mackerel, and solan geese, hold high carnival over slain herrings. The fishing generally begins about the 20th of July and ends in the middle of September. The neighbourhood of the harbour is certainly not savoury, nor is the appearance of the amphibious-looking mermaids who gut, clean, salt, and pack the fish, prepossessing. Had they come under the eyes of Miss Emily Faithfull, she would certainly have horrified the good folks of the Social Science assembly by an account of an occupation degrading to the fair sex. It is, however, a fine sight to see the fleet of boats leave the harbour of an evening, covering the sea with their sails, or to

watch them bearing up the Firth in one long unbroken line, stretching right across from East Lothian to Fife. The sails of five hundred boats may sometimes be seen between St Abb's Head and the Bass, glancing white in the sunshine; and at night the signal-lights stud the water, as if the sea, like the sky, had given birth to stars. The boats are, on an average, manned by five men each, and, with their nets, are worth about £200, representing a capital of £100,000. In good years, as much as £200 is earned per boat; and the quantity of herrings brought into Dunbar harbour alone, in a morning, has frequently reached the extent of 10,000 "crans," as they are called—each cran holding about seven hundred fish,—that is, seven million herrings in a night killed by the fishers of one village. Yet a far more deadly enemy to the herring than man is the cod, and the cod is only one of many deadly enemies, yet does the herring breed and multiply and replenish the sea. The herring harvest extends to the North British Railway, which carries many hundred tons per week of fish to London and other places; but we regret to say that, like the farmers, the fishermen have recently had to complain of bitterly bad seasons. Fishermen come from great distances, some to fish, some only to buy. Several of these are from Ireland, though, strange to say, Irishmen can scarce be got to fish their own seas, and the herring of Dublin Bay are chiefly caught by Englishmen. Formerly, hosts of Frenchmen came to Dunbar—wild-looking fellows—who bought legitimately and fished clandestinely, and jabbered with the native fishers in a manner that, though quite unintelligible, accomplished the great end of all language—an interchange of ideas; and herrings were bought and sold with many words and gesticulations, and the assistance of a little smuggled brandy. A change in the international laws has, however, put a stop to this traffic with the Frenchmen. But *revenons à nos moutons*; for it was sheep, and corn, and suchlike, that we intended chiefly to glance at.

There is no doubt that in soil, and still more in climate, East Lothian contrasts favourably with other Scottish counties, and that it produces more food for man than any other district of similar size. As an illustration, however, of the trite remark that there is nothing so deceptive as figures, we may refer to several of the elaborate tables of the excellent agricultural statistics of Scotland, so laboriously collected and ably reported to the Board of Trade by Mr Hall Maxwell.

We find, for instance, in looking over Table V. of the latest Report, that in 1857 no fewer than nineteen counties rank above East Lothian as to average acreable produce of wheat, and in 1856 the number exceeding it was twenty. The somewhat doubtful teaching of these figures is rendered more conspicuous when the acreage produce of small districts is given, and Mr Maxwell thus notices and endeavours to account for the apparent absurdity:—

"To many these Tables may present inconsistencies apparently irreconcilable with accuracy ; but these are the very features that will stamp their authenticity with those who are conversant with agriculture, and with the history of the last harvest. What confidence, it may be asked, is due to the estimates, in Table No. V., which attribute the greatest acreable yield of wheat to Lewis in Ross-shire, and Badenoch in Inverness-shire—for how can these districts compete with the Lothians in the production of that crop ? Or, Can it be in accordance with the fact that Arran stands highest for barley, Lewis for mangold, and Shetland nearly so for turnips ? The reply is, That where the acreage of any crop is the smallest, there the greatest acreable produce may be expected, in respect that such a crop is purely exceptional, grown on small patches of the finest soil, and treated in the kindest manner. Thus we find that Lewis and Badenoch, with their 40 bushels per acre, grow respectively $7\frac{1}{2}$ and $2\frac{1}{2}$ acres of wheat ; that Arran has only $11\frac{1}{2}$ acres of barley, Shetland 124 of turnips, and Lewis three-quarters of an acre of mangold. Each of these cases affords an example of the smallest area combined with the largest return per acre."

We confess we can scarcely accept this explanation. In the first place, the fact seems to be overlooked that unexpected results are not confined to minute districts, but that such considerable wheat-producing counties as Berwick, Forfar, Kincardine, Linlithgow, and others, outstrip East Lothian.

But as regards small patches of unaccustomed crops, we must dissent from the proposition that there the greatest produce may be expected. We should rather expect that the reverse would be the result. Soil and kindly treatment cannot overcome the influence of adverse climate ; and the patch of $7\frac{1}{2}$ acres in Lewis, devoted to wheat, could not be much better off as to weather than the other acres in the island.

" The self-same heaven
That frowned on them, looked lowering upon it."

We should expect that vines, however tenderly cared for in Kent ; mangold, however highly manured in East Lothian ; and wheat, however forced in Bute or Badenoch, would not yield results equal to those obtained from the same crops in more congenial situations. The real cause for the large acreage returns of wheat in such places as Badenoch is, we apprehend, rather to be found in the undoubted fact that there is a constant tendency to error in the direction of excess when gross returns are founded on calculations based upon minute patches of crop. The farmer who thrashes out and measures the produce of an acre, and calculates his crop thereby, is almost sure to deceive himself by a too flattering prospect. Though Badenoch is not quite so transcendent in the *weight* of its wheat as it is in quantity per acre, yet there is nothing in the table devoted to the "weights of grain" which could indicate any pre-eminence on the part of Haddingtonshire in the real value of its produce ; but when we turn to another class of statistics—the fiars prices for Scotland—we find, to the joy of East Lothian landlords, to the comfort of its clergymen, but frequently to the dismay of its grain-rent-paying

tenants, that the seven years' average of the fiars prices for wheat in the county is about 8s. 7d. higher than that of the rest of Scotland, 11s. 3½d. higher than Forfarshire, 9s. 3½d. higher than Berwickshire, 8s. 5d. higher than Roxburgh, and 9s. 2½d. higher than Edinburgh, to which market so much of its best grain is sent for re-sale from Haddington.

East Lothian may claim a comparatively ancient date for its cultivation, as we read that, in 1296, the invading army of Edward I. subsisted on the beans they gathered in its fields; and in 1336, a period when Scotland was harassed and devastated by constant hostilities, *a hundred ploughs* were stopped in the shire, and the county divided into hostile factions in a little war of its own—Alan of Wyntoun having forcibly carried off one of the daughters of the Laird of Seton. Long afterwards, as Whitelock tells us in his Memoirs, Cromwell's soldiers were "astonished with the greatest plenty of corn they ever saw, not one of the fields being fallow." But it is probable the absence of fallow was caused by the farmers being ignorant of its use; and its introduction so lately as the beginning of the present century is claimed for John Walker, tenant of Beanston, to be again disused and almost forgotten in times that can brook no Sabbath rest to the ever-turned soil. In more modern times, Fletcher of Salton, and his *protégé* Meikle, the millwright; Cockburn, and Weight of Ormiston—an early and successful cultivator of the turnip—Brown of Markle, and Rennie of Phantassie, have all, at various dates and in different ways, advanced the agriculture of their county.

The first agricultural society was formed at Ormiston in 1743; whilst another, more generally useful, was founded at Salton in 1804, which, in its turn, was absorbed by the present thriving association, which was established in 1819 by the leading agriculturists of the county. While, however, the county owes much to individuals in the earlier history of its agriculture, it is to the intelligent enterprise of the general body of its occupants, together with a most unusually large expenditure of capital on their part, that East Lothian really owes whatever pre-eminence it may have as an agricultural district. We would claim for the county that no equal space of land in the empire has been more thoroughly drained, more skilfully and laboriously cultivated, or more expensively manured—a second rent being every year spent in purchased fertilisers. Upon the whole, Nature has done her part, and the crops, both in abundance and in quality, have not been disproportionate to the efforts made to raise them; and yet, in spite of all this, lands, at present rents, do not and cannot pay. It is only too certain that almost every successive year sees the capital of the farmers, as a body, diminished in place of being increased. Of course we are met in the face by the fact that, year after year, the rent of land has continuously risen. Free trade apparently produced an effect upon

the value of land the very reverse of that which Protectionist and Free-trader alike predicted. The Protectionist prophesied that fields must go out of cultivation, and that rents would experience a material fall ; whilst Mr Cobden did not foresee that, on the contrary, the property of the landowner was to be vastly increased in value, and that every farm brought into the market would draw around it a crowd of anxious and excited offerers.

It is not our purpose to inquire into the causes which have produced such unexpected results. The discovery of large quantities of gold in various parts of the world, a sequence of several years of good crops with exceptionally high prices, the occurrence of a European war, the vast extension of railways, the greatly augmented trade in potatoes, and the increased value both of meat and wool, were no doubt leading reasons for the rise in the value in land ; but in spite of all these causes, we cannot but regard the simultaneous rush which so many persons have made upon farms as partaking of the nature of a *mania*. Very seldom during the last twenty years have farms been re-taken by the former tenants ; a new occupant has been the rule and not the exception. The men who, by personal experience, knew best what a farm could pay, and who were attached to their homes by the residence of a lifetime, were almost never the successful offerers, but were outbid by strangers, who brought with them a certain amount of capital that had frequently been made in other professions, and which they were willing and anxious to invest in undertakings, with the risks of which they could not be thoroughly acquainted.

With many natural advantages, East Lothian has some minor, but still serious, drawbacks as compared with other counties, which do not at all seasons strike the eye of a stranger. Grain crops frequently suffer most severely from destructive winds. Possibly hurricanes may blow as fiercely in several other parts of the country, but in few, if any, is there such an amount of valuable agricultural produce totally exposed to their violence. Most of the large fields of corn are unprotected by plantations or other shelter, and thus winds, sweeping over them with unbroken force, shake out the grain, and break down the stalks. During the dismal summer of 1862, two storms of wind, which occurred on the 19th and 25th of July, did more damage in a few hours than was done by months of rain. Two instances of damage particularly attracted our attention. A field of beans and a field of wheat were in the morning as fine specimens of the respective crops as a farmer could wish to see ; at night they were crushed, broken, beaten flat, and, in fact, almost utterly destroyed. Perhaps, however, we ought to place at the head of the difficulties which affect the agriculture of East Lothian in a peculiar manner, the strong tendency of much of its best soil to produce some species of annual weeds. A distinguished English agriculturist, passing through the county last summer, declared that the

fields were a disgrace to British farming; but he was not aware of the desperate battle which the hoe and the plough have ceaselessly to wage against the ever-victorious wild mustard, and the unconquerable wild oat.

Nature in East Lothian is profuse of yellow. If Linnæus fell on his knees and thanked Providence for having brought him to a land where the hills are often like piles of golden ore from the bloom of the whin, the farmer may hold up his hands, but not to thank his stars, when he sees his barley and oat fields like so many "cloths-of-gold." Many other annual weeds often perplex the most industrious agriculturist; and if it be said that this is a proof of the fertility of the soil, it must be allowed it is a heavy tax upon it. But by far the most insidious and the most formidable of weeds is the invincible wild oat. When this abominable plant once gets possession of the soil, it generally keeps it. There are farms upon which the wild oat seems to defy the most skilful and thorough cultivation—deep ploughing, drill sowing, successive root crops, all specially directed against it. The seed seems to form a portion of the very soil, and to be preserved invulnerable by nature. It refuses to germinate when coaxingly offered the most favourable opportunity, but seems to lie in wait till corn is sown, and then to rush from its countless lurking-places to strangle the crop. In the struggle for existence it is not the finest grain that struggles most successfully.

The prolificness of the wild oat is amazing. We this season examined a vigorous plant in a portion of a wheat field, where the oat, like the cuckoo in the sparrow's nest, had completely taken possession, and pushed out the rightful occupier. It consisted of ten stalks, and each stalk averaged a hundred pickles; thus the original seed had multiplied itself a thousandfold. An agriculturist of Fife, who knows East Lothian well, was some time ago consulted by a friend as to a farm he had looked at in the latter county. When other matters had been discussed, the intending offerer was asked, "And the wild oats, what did you allow for them?" "Wild oats! what are they?" said the man from a distance. "If you don't know what wild oats are," was the reply, "they will teach you on that farm to the tune of thirty shillings an acre." This pest of the farm is unfelt in the higher districts of the county.

We have already said that, in spite of all the high farming, farmers have been losing money. It seems, indeed, as if the soil had a constitution like the human body. Mithridates got used to poisons; the drunkard requires every year larger potations; and old mother earth seems to get accustomed to stimulants too, and to demand now what formerly would have been an overdose of manure. Several bad seasons coming in succession have severely tried the stamina of the farmers, but the late harvest has been peculiarly bountiful. All descriptions of corn crops were above an average, and

the grain was gathered satisfactorily ; whilst the potato-fields have generally yielded a singularly weighty return, and in the whole county we doubt if there is a diseased tuber. Such being the case, farmers naturally thought they had at length secured a store that was in some measure to repay them for the heavy losses of previous years. But, alas ! they seem menaced with the lot of the old Arabian fisherman, who, after bringing up time after time nothing but mud in his net, at length found it filled almost to breaking. He thanked Allah, and gaily drew the net to shore, when lo ! in place of good fish, it contained only the carcass of a dead ass. True, it is not a dead ass the farmers have now got in their barnyards and potato-pits, but, on the contrary, they have secured what they fished for ; but good wheat sells for 40s. per quarter, and, while we write, we observe in the newspaper of the day the following laconic report of the potato market :—"Spitalfields, London, completely overstocked with potatoes, which are not saleable at any price." Wheat, the staff of life—the staff upon which the East Lothian farmer leant—has bent under the weight put upon it, and the potato is at all times capricious and uncertain ; but hope still points to pastures new : the East Lothian farmer is reminded that mutton is at 8d. per lb., wool 50s. per stone, and that he must pit his dear land against grass farms, that he must feed sheep, and manure his fields by the use of bilcake rather than of guano.

The total alteration of a system of farming is in itself no easy matter, and the importation of cattle and sheep from other districts is now beset with peculiar difficulties. That ancient name, but, practically speaking, new disease, murrain, may now be looked upon as a cause of annual loss to the farmer. Cattle and sheep bought at markets or fairs are almost absolutely certain to take foot-and-mouth fever, within a week of their being purchased. As regards cattle, their losing about a month's keep is generally the most serious consequence ; but sheep suffer much more severely, and a considerable percentage never entirely recover. Then, too, in spite of all precautions, the disease is frequently communicated to the ordinary stock of the farm, and the loss in that is greater from the animals being forward in condition.

In spite of all that has been written on the subject, the prevalence of murrain remains a mystery. If mere travel is the cause, why has the disease not always existed ? and why should sheep now bought at Falkirk, for example, be certain to be smitten, when it was not so formerly ? That the disease is very highly infectious is certain, and yet the exceptions to the rule are very curious. In the experience of a single farm, we happen this season to have witnessed some remarkable instances both of infection and of exemption from it.

In one case three Yorkshire calves, bought in Edinburgh, were turned into a paddock beside a fourth calf reared on the ground, all four animals being expected to take murrain, as a matter of course. One of the purchased calves soon exhibited the symptoms of a severe

attack, and a day or two afterwards the four animals were driven, by mistake, into a field where a score of home-bred healthy rams were grazing. This error was discovered in less than an hour, and the calves removed, but it was too late; and in a day or two the rams were down on their knees in a sharp attack of the disease, and yet none of the calves ever caught the disorder save the one originally affected. Then again, a lot of Yorkshire cattle, in good condition, were purchased at Linton market, and placed for ten days on a field of grass: they were then divided, and placed in two sets of cattle-courts, a mile apart, but circumstanced exactly alike, and in which there had been no other oxen for many months. The one-half of the divided lot took murrain severely the day after they were housed, the other half never took it at all. Finally, as regards the experience of the present season, a lot of Cheviot sheep were bought at Falkirk, and the whole having taken murrain very severely as soon as they arrived, three of the same breed that happened to be upon the farm were placed among them. These three Cheviots, though remaining among the diseased flock, have never been attacked by the disease. Last year we found from experience that sheep may have a second attack soon after their recovery from a first. A large lot of sheep purchased in summer took murrain severely, but in autumn, though the disease still lingered, it had in a great measure disappeared from the flock. At that period the winter stock of cattle was purchased, and it being certain they would take murrain in any event, they were placed in a grass field beside the convalescent sheep, and fed for a week upon turnips together. The result was, that the cattle, as anticipated, took murrain, but, what was not suspected, they in turn gave it to the sheep; and this second attack was the most severe we have ever witnessed, and in fact ruined a large proportion of the lot, and damaged the whole.

It seems to us clear that, though fatigue, over-driving, cold, and privation may sow the seeds of murrain, its breaking-out is greatly expedited by a sudden change to comfort and repose. We cannot otherwise account for the fact that, while all cattle bought at such markets as are held early in the season take the fever within a fortnight after they reach the homesteads, yet the balance of the dealer's stock which remains unsold is produced at the later markets, for the most part free of disease, though as soon as the animals change owners the disease breaks out. During the wet summer of 1862, murrain in sheep seemed to be the parent of a much worse disease, and preceded, if it did not induce, foot-rot. East Lothian, with its dry climate and drained soil, has been almost exempt from this abominable evil; but last year almost every flock in the county was more or less afflicted by it, and many show traces of its ravages up to the present date. As to remedial measures for murrain, while we read every week in agricultural newspapers of medicines for the stomach, lotions for the mouth, and poultices for the feet, farmers, we think,

act very properly upon Macbeth's principle, and throw physic to the dogs. Bullocks, like boys, are apt to kick at medicine, but cannot, like them, be bribed with sugar-plums. The force necessary to physic a lot of oxen would do them far more harm than good. The only treatment both of cattle and sheep is obviously to give them proper shelter, and good food in forms that are most tempting and most easily swallowed.*

While murrain is so universal in its attacks, it is fortunate that the deadly pleuro-pneumonia is comparatively rare, at least in well-selected stocks of cattle. The great, and indeed only, safeguard is to buy nothing but evidently thriving, comfortable-looking animals—the fatter, of course, the better.

Once attacked, the only cure is to be looked for from the butcher, and not the doctor; and this we regard as a fair and proper course, Mr Gamgee and police magistrates notwithstanding. Why should not cattle attacked by lung-disease be killed and eaten? Has there ever been one single instance proved of injury to health arising from the use of such meat? If the lungs of the ox are diseased, don't eat them, but why not eat beefsteaks from the animal? Hobbies are amusing entertainments, and simply riding them may be an innocent amusement; but when those who cannot convince determine to coerce, and also obtain the power to do so, the matter becomes serious. If the diseased-meat maniacs would restrict themselves to telling us "what to eat, drink, and avoid," they would be all very well; but we decidedly object to having to consult a policeman before we dine, in case we disorder our stomachs.

Things appear to have come to a crisis in London, and there the alarmists have it all their own way, as the weekly police reports abundantly testify. A butcher the other day was sent to jail for three months because he was selling beef which the inspector declared unwholesome, though half-a-dozen apparently competent witnesses swore the reverse, and said they had eaten of the beef with satisfaction as well as impunity. When we constantly read of ruffianly cowards beating women almost to death, and then being slightly fined or imprisoned for a few days, the following newspaper paragraph reads like a hoax:—

"CONVICTION OF A SCOTCH CATTLE-DEALER FOR SELLING DISEASED MEAT IN LONDON.—At the London Central Criminal Court on Wednesday—before Mr Commissioner Kerr—Alexander Stewart, a cattle-dealer in Perthshire, was indicted upon a charge of having caused to be exposed in Newgate Market 300 lb. of diseased meat, the same being wholly unfit for human food. There were also four other counts in the indictment. Mr Sleigh, Mr Poland, and Mr Nicholson prosecuted; and Mr Metcalfe defended the prisoner, who pleaded not guilty. From the very voluminous evidence laid before the court, it appears that a person named Fairleigh lives at Coupar-

* The attempt now being made in England to arrest the progress of murrain by prosecuting the owners of some of the affected cattle found at fairs, is like stopping one hole in a sieve.

Angus, in Perthshire, where he carries on the business of pig-jobber, and in September he was possessed of two cows which appeared to be suffering from a disease of the lungs, and which he therefore desired to dispose of to the best advantage. The prisoner resided close by, and on hearing that these two cows were for sale, proceeded to Fairleigh, and after some bargaining ultimately agreed to give him £3 for the two. Fairleigh consented, the prisoner gained possession of the cows, and at once engaged the services of a killer; the cows were slaughtered, and were nicely dressed, and then consigned to a Mr Leigh, of Newgate Market. In due course the Inspector of Meat came round, and, seeing the state of the meat consigned by the prisoner to Leigh, at once pronounced it unfit for human food. It was taken before a magistrate, and there and then condemned, and proceedings taken out against the prisoner. For the defence Mr Metcalfe addressed the jury at considerable length, urging that it could not be denied that the prisoner had sent the meat to Mr Leigh, but at the time he did so he was quite unaware that it was unfit for human food, and he was therefore clearly entitled to an acquittal. The Commissioner summed up at considerable length. The jury immediately returned a verdict of guilty. Mr Commissioner Kerr asked the meat inspector what effect this bad meat would have upon people if partaken of? The officer said, According to Dr Letheby, carbuncles would be produced upon the body, as well as diarrhoea of a very severe nature, and in many cases death would result. Mr Commissioner Kerr, addressing the prisoner, told him he had been convicted, after a patient hearing, of a most serious crime; indeed, he did not know of anything more serious. Death might result from the bad meat being partaken of, and if so, of course it was little short of murder. This kind of thing was very largely on the increase, and it was his duty to pass a very severe sentence. It had come out in evidence that his own men, when he had killed the cows, had cut the lungs up and found them to be diseased, and had afterwards told him (prisoner) so. Certainly he could not think of anything more reprehensible than his conduct had been throughout the whole proceeding. It had appeared from the evidence that a very large quantity of bad meat came from the neighbourhood of Coupar-Angus, and he hoped that after the sentence which he intended to pass had been recorded, the people about that locality would be more careful for the future what they sent to London in the shape of meat. *The Commissioner then sentenced him to be imprisoned for the space of twelve calendar months—at the expiration of which time to pay a fine of £50, or to be imprisoned until such sum should be paid.* The prisoner was then removed, when Mr Commissioner Kerr severely censured the first witness, Fairleigh, who had sold the prisoner the cows, and he expressed his opinion that he (the witness) ought to have been placed in the dock with the man Stewart."

That the 300 lb. of meat were sent for sale by the prisoner was of course proved in evidence, and that it was injurious to health the jury had the deposition of the inspector, whatever that might be worth. The judge stated that the sale of such meat was a common occurrence; but no attempt was made to prove that any bad consequences had ever followed, and Stewart seems to have been sent to prison for a year, with the prospect of further incarceration in case he could not find £50 to pay a fine, mainly upon the *rumour* that a Dr Letheby held an opinion that such meat was unfit for human food. Bad whisky and cheap gin are perhaps as likely to produce pimples (particularly on the nose), diarrhoea, and even death, as any beef likely to find purchasers in an open market; yet we have not

observed that even Mr Gough proposes that such punishments should be introduced into the liquor trade ; and we strongly suspect that for one person in London hurt by eating defective meat, ten thousand persons are much more hurt because they cannot get any.

A grocer is punished who sells chicory under the name of coffee, and by all means let butchers be compelled to ticket inferior beef with some descriptive designation, after which, we think that in such a simple matter the public might safely be left to take care of itself.

We have remarked that comparatively new diseases in cattle and sheep form impediments in the way of fattening stock ; and as an additional hindrance, we may mention the very frequent, and in a great measure unaccountable, failure of the red-clover plant. This difficulty, though often experienced in other counties, is, we believe, felt in a peculiar degree in East Lothian, where in very many cases it defeats the calculations of the farmer. Various reasons have been suggested for this uncertainty in the growth of the clover—as, for instance, the discontinuance of bare fallows, the absence of farm-yard manure, the sickening of the ground from too frequent repetitions of the crop. It has also been affirmed that the roots of recent clover crops, remaining undecomposed in the soil, act injuriously upon those of the new plants. The latest suggestion we have seen is, that to secure a clover crop no other description of grass seed should be sown. Crops of clover, however, entirely succeed, as well as utterly fail, under all these circumstances ; and we think that the problem of these eccentricities remains still to be solved. A writer of a prize essay in this Journal argues that the reason of the disease in the larch arises from defective seed, and it may interest our readers to see a rather curious theory as to clover seed by the greatest of our living naturalists. Mr Darwin, in his now famous volume on ‘The Origin of Species,’ thus writes in reference to the clover plant:—

“ I am tempted to give one more instance showing how plants and animals, most remote in the scale of nature, are bound together by a web of complex relations. . . . Many of our orchidaceous plants absolutely require the visits of moths to remove their pollen-masses, and thus to fertilise them. I have also reason to believe that humble-bees are indispensable to the fertilisation of the heartsease (*Viola tricolor*), for other bees do not visit this flower. From experiments which I have lately tried, I have found that the visits of bees are necessary for the fertilisation of some kinds of clover ; but humble-bees alone visit the red clover (*Trifolium pratense*), as other bees cannot reach the nectar. Hence I have very little doubt that, if the whole genus of humble-bees became extinct or very rare in England, the heartsease and red clover would become very rare, or wholly disappear. The number of humble-bees in any district depends, in a great degree, on the number of field-mice, which destroy their combs and nests ; and Mr H. Newman, who has long attended to the habits of humble-bees, believes that ‘ more than two-thirds of them are thus destroyed all over England.’ Now the number of mice is largely dependent, as every one knows, on the number of cats ; and Mr Newman says, ‘ Near villages and small towns I have found the nests of humble-bees more numerous than elsewhere, which I attribute to the number of cats that destroy the mice.’ Hence it is quite credible

that the presence of a feline animal in large numbers in a district might determine, through the intervention first of mice and then of bees, the frequency of certain flowers in that district !”

This indeed reminds us somewhat of ‘The House that Jack built.’ As gamekeepers are the great enemies of cats, a new edition of the old story may run thus :—“ This is the keeper that shot the cat, that killed the mice, that robbed the bees, that sucked the flowers, that made the seed of the farmer’s bright red clover.” Assuming the statement to be fact, we imagine that the only manner in which it could have any bearing upon clover as a pasture-crop in Scottish agriculture, would be by causing the purchased seed to be weak and defective, from want of thorough fertilisation by the visits of bees.

In the course of communications which we have the honour to hold with Mr Darwin, we took the liberty of drawing his attention to the fact that field-mice have far more constant and deadly enemies than the cat, which is quickly destroyed by gamekeepers when it strays far from home. Weasels, kisterls, and owls are the great destroyers of field-mice. During the long and severe snow-storm of the winter of 1860, we were astonished by the number of field-mice that were to be seen running along the beaten tracks in the middle of the public roads, whilst numbers of owls regularly hunted them all the moonlight nights, flying along the roads as swallows do along rivers hunting flies. Mr Darwin quite admitted the truth of the remark as to birds of prey and weasels, and drew our attention to the fact that he had adopted the theory of the cats from Mr Newman.*

Whilst grass for summer food is thus to a certain extent a precarious crop, the turnips which form the winter supply may be pretty surely relied on ; and farmers are beginning to think that Mr Mechi, however wildly he often shoots his arrows, fires in the right direction when he tells them to save their guano-bills, and manure the land through their sheep, by increased purchases of artificial food. Cattle in East Lothian are looked upon almost in the light of necessary evils. Few are ever grazed, but large numbers are required in winter to act as machines for crushing the straw into dung. The present hope of the farmer is in flocks, and not in herds—not, indeed, to turn the country into a grazing district, for which it is not fitted, but by raising as large a quantity of roots as possible, and, by the use of cake, to fatten an increased number of sheep. To grow this increased bulk of roots, and also to add to the average return of their corn crops, many farmers in East Lothian now turn their thoughts anxiously towards cultivation by steam. Already four sets of apparatus, comprising three different systems (Fowler’s,

* The field-mouse is a most interesting little animal. In spite of the number which we have observed were driven by hunger to feed on the roads at the end of a long winter, the field-mouse makes a most comfortable winter burrow, which he stores with incredible quantities of grain—ears of wheat and oats. We were also astonished to find, by personal observation during the late summer, that the little fellows build large and comfortable nests of moss high amidst the branches of tall fir trees.

Howard's, and Coleman's), are at work within sight of each other ; and we are mistaken if the ensuing year does not see some augmentation of this number ; and it is not impossible that at no very distant date the most purely agricultural of counties may present somewhat of the appearance of a manufacturing district. With steam chimneys already on every homestead, and a puffing locomotive by-and-by on many farms, not to mention the whirl of hundreds of reaping-machines at harvest or hay time, the fields of East Lothian will cease in some degree to present the usual appearances of agricultural industry. Not much hope exists that any material reduction can be made in the staff of horses kept on the farm ; and the steam-plough must pay—if it is to pay at all—by more effectual cultivation of the soil, and, as a consequence, an increased amount of produce. It is all very well in England to talk of large reductions in the numbers of horses, or of oxen kept for labour, as resulting from the adoption of steam ; but in Scotland we have no such amount of animal power to reduce. The statistics of steam cultivation, as published in England, show a larger staff of horses retained in the various farms than are kept in Scotland for the entire working of the soil.

Besides the fact that in Scotland we have, in adopting steam, little to hope for in the way of a reduction in the amount of horse power, there is on a large number of farms another serious impediment. This is the vast number of stones which, in spite of many years of careful cultivation, still lurk in the soil. Most of the boulders, indeed, are already dug out to the depth ordinarily reached by the common plough ; but the moment that depth is exceeded, great numbers are found, and however expensive their removal, that expense must be encountered before steam is used, otherwise constant breakages will be the consequence. The time and cost of this operation is sufficiently large to deter many farmers, already struggling against high rents, from entering unaided on the enterprise ; but we observe, nevertheless, that since steam cultivation was introduced into the county, an impulse has been given to boulder-digging, and many fields assumed, during last winter, the appearance of graveyards, bristling as they did with excavated stones. This, with deeper ploughing, must improve the cultivation of the county, even though steam should not ultimately be adopted.

Having resolved to adopt steam, the farmer is not a little perplexed, in purchasing so expensive a machine, which of four or five implements it would be most prudent to choose. There can be little doubt, perhaps, that, viewed *per se*, Fowler's is the most complete implement ; but when we consider the difference in price, and the fact that other machines are better adapted to imperfectly prepared fields, the balance in most minds will incline towards one or other of his rivals'. Experience seems fully to have proved in East Lothian that Fowler's system involves a large annual charge from breakages wherever boulder-stones are plenty, whilst other descriptions of

steam apparatus are worked with much less loss under this head. A locomotive, with direct traction, has evidently great advantages over what is denominated the "round-about system." It moves itself, and does not require the intervention of horses, which are frequently strained and racked by the ponderous weight they have to drag; whilst the extreme length of rope required by such systems as Howard's, for example, is a source of annual loss. On the other hand, the "round-about system" is better adapted to reach the angles of such irregularly-shaped fields as the farmer finds he has to deal with, and it cultivates nearly as much ground in a week as Fowler's at a less cost of capital, though with a larger amount of manual labour. Upon the whole, as Sir Roger de Coverley observed, "there is a good deal to be said on both sides." If locomotion and direct traction are fixed on, a purchaser would do well to see Coleman's system at work, as it costs much less money than Fowler's, and, so far as East Lothian experience goes, does its work in a satisfactory manner. Coleman lacks Fowler's beautifully ingenious anchor, but finds some compensation, when a boulder is encountered, by the tackle being permitted to yield to a slight extent, from being less firmly fixed to the ground.

The designation of steam-plough will, we imagine, become almost a misnomer, as so many persons now doubt the propriety of a reversal of the soil by the action of the plough. The system of ploughing-matches may be said to be on its trial. The neat ploughman, pressing as he does the subsoil into a solid body, and turning over the surface in long compact slices, regular as the stripes upon his own corduroy breeches, and forming for the soil a coat of mail against the influences of the atmosphere, is no longer the boast of the farm. The prize plougher is not prized by his master; and Fowler's balance-plough, ingenious though it be, seems likely to give place on most soils to the "scarifiers," the "grubbers," the "diggers," and the "cultivators," that tear, toss, tumble, and shake the ground till it lies loose and open to the action of the air. The scarifier, driven by steam, tears up the earth as if an army of moles had come to the aid of the farmer.

Twice before has the steam-plough been used in East Lothian, but in both these cases it was given up, though one of the implements was in the skilful hands of the Marquess of Tweeddale. It is to the enterprise of tenant-farmers that East Lothian owes its reintroduction; and if, as seems almost certain, steam is destined quickly to revolutionise our system of cultivating the soil, it will be to their unaided exertions that the change is due.*

* We may mention that it was at Drem, where one of the four sets of steam apparatus is now at work, that the first steam-engine in the county, for the purpose of thrashing corn, was erected. The machine was set up by the late Mr Reid, father of the present occupier of the farm, in the year 1818, and is at this day one of the best engines in East Lothian.

ON THE CULTIVATION OF FLAX.

It has become absolutely necessary to look carefully into every matter which appears to present even a tolerable prospect of enabling us to meet the pressure, caused by close competition and other contingencies, under which farmers labour at the present time. We feel that the routine we have been following will not do; we must break in upon it in some way or other; and the grand question is, How is this to be done? Some recommend greater attention to cultivation and its multifarious details; while others are equally earnest in dissuading people from having anything to do with tillage, or at least as little as possible. Without entering into the merits of those rival modes of solving the question at issue, it is evident that, if we can substitute a crop for which there is always a constant and remunerative demand, in the place, or partially in the place, of another which is more open to competition, a great step will be gained, particularly if the nature of the substituted crop is such that an increased supply of it will, in all probability, lead to a greater demand for it.

That such is the nature of the flax crop we have no hesitation in maintaining. The demand for it is, to a certain extent, limited simply because the supply is limited. That manufacturers could take, and would take, a much larger supply of the raw material than they have at their command at present, is a known fact. The supply derived from home sources, as well as from northern continental Europe, is quite insufficient to meet their requirements, and additional supplies are now sought to be obtained by encouraging the growth of flax in India. As an evidence of the insufficiency of the home growth to meet the demand, we have only to look at the state of the linen-manufacture in Ulster. The consumption of flax in that part of Ireland exceeds 100,000 tons a-year, while the average production of flax in all Ireland does not exceed, on the average, 30,000 tons. Flax cultivation is chiefly confined to Ulster—207,246 acres of flax having been grown last year in that province, while the total amount grown in all Ireland was 213,992 acres, being, however, an increase of 63,922 acres over the extent cultivated in 1862. Various causes have prevented the extension of flax cultivation in the other three provinces into which Ireland is divided; but these are being removed, and we may look for a considerable increase taking place, especially in Munster, where the subject appears to have been taken up in a very spirited manner.

The linen manufacture is also carried on extensively in several parts of Scotland, the supply of material being chiefly derived from foreign sources. On referring to a parliamentary return, dated 15th August 1850, we learn that there were in Scotland at that period 188 flax-factories, 303,125 spindles, 2529 power-

looms, and that 28,312 persons were employed in the manufacture. In 1857, Mr Hall Maxwell's statistical returns showed that there were only 1535 acres under flax in Scotland—proving that the home supply of flax was very far short of the quantity required to keep all those factories at work. We are not in possession of similar statistics of the linen-manufacture in England, but we learn from the census of 1861 that 22,051 persons were engaged in it at that time in England and Wales. We are also aware that a good deal of flax is grown in different parts of England, although we have not any agricultural statistical returns from that part of the kingdom to guide us as to the actual extent under this crop. About Selby in Yorkshire, and also in Somersetshire, flax has been grown for many years, as well as in other parts of England; and with reference to this point we give the following extract from a report from Selby, which appeared in the 'Mark Lane Express' of the 1st ult.: "Flax," says the reporter, "is again being more cultivated. Linseed is pretty well inquired for, this district bearing a good name for furnishing a genuine article."

Our imports of flax from foreign ports during late years have been as follow:—

	1861. Cwts.	1862. Cwts.
Russia and Prussia, .	1,031,044	1,387,133
Holland, .	123,404	139,790
Belgium, .	130,216	163,405
Other countries, .	49,015	108,023
Total,	1,333,679	1,798,351

To which may be added the following items:—

	1861.	1862.
Flax-seed and linseed, .	1,160,270 qrs.	1,088,472 qrs.
Oilseed cakes, .	113,725 tons.	101,156 tons.

The official returns for last year have not reached us in time to give them in this article.

It may be alleged that an increase in the supply of the raw material, either from home or foreign sources, would tend to lower its value, and thus render the cultivation of flax unremunerative to the home producer. We do not believe that such would be the result. We have already said that the demand for, or rather the consumption of, flax is comparatively limited, because manufacturers cannot obtain as much as they can work up into manufactured goods—it is not because the demand for the manufactured goods is limited; and it is a curious fact, which should not be overlooked, that although linen goods are now obtainable at a less cost than they were at one time, the value of flax has not been lowered, any decrease in the value of manufactured goods having been effected by improvements in the various stages of the manufacture, and not in the primary cost of the raw material. This fact, therefore,

shows that no fears need be entertained of overstocking the market, should the home production of flax be considerably increased.

Although flax forms at present but a small proportion of the crops grown in Scotland, it was not always so. As far back as 1727 the Board of Manufactures and Fisheries had a number of persons instructed in the cultivation and management of flax, and those "practical instructors" were scattered throughout Scotland for the purpose of superintending the cultivation of the crop and the preparation of it for the manufacturer. The "British Linen Company," so well known as a banking establishment, owes its origin, we believe, to that undertaking. Bounties were given by the Board of Manufactures for the purpose of encouraging farmers to grow flax, and this system was afterwards continued by the "Society for the Improvement of Agriculture," the parent of the Highland and Agricultural Society of Scotland. The cultivation of flax was one of the favourite schemes of the late Sir John Sinclair of Ulbster, and the efforts of that truly patriotic man were not limited to mere advice bearing on the subject. He erected scutch-mills on his estates in Caithness, and established a bleachfield near Thurso, of which only the name now remains to tell that such formerly existed, although we can remember the time when the large haugh above "the Salmon Pool" on Thurso river was covered with webs of linen, and the bleachfield kept in tolerably constant operation. Many of our readers too, we daresay, will easily recollect the well-filled "presses" and chests of "napery" which every thrifty Scotch housewife considered it her bounden duty to possess, adding annually to her stores of sheets, table-cloths, towellings, and shirtings, although years might pass before any portion of those stores would be put to actual use. It was almost considered, in fact, a species of desecration to use any portion of them until the "plenishing" required for a daughter when she left home as a bride, or for a son when he "set up house," necessitated an inroad on the well-kept store. And we can tell those who only know the cotton substitutes of modern days, that a home-made "harn sark" was something like what a shirt should be, for with ordinary care it would last nearly half a man's lifetime. We daresay such stores of home-made linen are still to be found in some parts of Scotland, and if so, happy, say we, are those who possess them.

The agricultural reports of the Scotch counties, published about the beginning of the present century, and other publications of that period, contain frequent references to the cultivation of flax. Thus, in Dr Robertson's Account of Perthshire, we find that "the culture of flax is universal," particularly "in the districts of Stormont, the west end of Strathmore, and Athole;" that "the foot of every brook in the Highlands, where the water runs slowly, and plenty of sediment is deposited, making an annual addition to the soil, carries amazing crops of lint;" that lint "is raised successfully, the second crop

after good clover-lea ;" and that in the Carse of Gowrie flax "sells from £9 to £12 the acre, *when disposed of before pulling.*" Dr Robertson gives a number of good practical directions for the cultivation of the crop and its subsequent management, which read almost as if issued only the other day. Dr Smyth says, in his report on the agriculture of Argyle, that "few things would contribute more to the advantage of this county than the raising a great quantity of flax, for which our soil and climate are well adapted ;" and he states, that "in the higher parts of Perthshire, adjoining to this county, the ordinary farmers commonly pay all their rent by the sale of linen yarn." He estimated "the produce of a single acre at £15 on the field, at £20 when it comes from the mill, at £60 when spun into yarn, and at more than £100 when wrought into cloth and bleached." In Somerville's Report of East Lothian it is stated that "flax has been sown in this county from time immemorial ;" that, "sown upon fresh moors, a handsome return was sometimes received from land comparatively of little value ;" and that "seed, which was sold to other districts, was raised of a quality equal, if not superior, to that which is every year imported from Holland ;" and he further states that "some farmers have sown flax-seed, raised on their own land, for ten successive years, without perceiving any degeneracy." The same writer addressed a lengthy communication to the Board of Agriculture on the subject of flax cultivation, and that communication is given in the 'Transactions' of the Board. He observes that "flax is an article so essentially necessary to the British kingdom, that it is a matter of astonishment the cultivation of it should be so much neglected, and the management even of the small quantity that is cultivated so very defective ;" that "there can be little doubt that immense quantities might be raised in Britain with little labour, and that, too, upon soils where hardly anything else will grow ; and every part of the management, from the time of sowing till it is manufactured into flax, very easily taught to the country people." He then proceeds to state "the purpose" of his communication—namely, "first to give a general sketch of the present mode of cultivation and managing of flax ; then to enter into the detail of the principal operations, point out what appears defective in each, and offer some hints for improvement." The manner in which Mr Somerville treated the subject, as well as the important nature of many of the points which he brings under the notice of the Board "as worthy of minute investigation" and of "experimental inquiry," shows that he must have given it very close attention ; and certainly most of the arguments used by him are quite as applicable to the times in which we live as they were to those when he wrote.

Various causes, however, militated against an extended cultivation of flax in Scotland. The high prices obtained for grain in the early part of this century contributed to prevent flax from being grown to

any considerable extent, and there was also a prejudice against it as a more than usually exhausting crop, which led to a restriction being put on its cultivation by landlords; and the restrictive clauses then introduced are still to be found in many leases of modern date. It is too much the custom, however, to draw up leases according to some prescribed rule, and, generally speaking, we seldom find that lawyers know much about farming. They cannot be expected, therefore, to see the absurdity of many things they insist upon introducing into the leases which are intrusted to them for the purpose of being drawn out; and farmers have been too much in the habit of agreeing to conditions without thinking much about them, glad enough, perhaps, to get the farm they wish to have, without inquiring too minutely into the terms of lease by which they are to be bound for nineteen years. The restriction of flax, or "lint," as it is usually termed in leases, has served to fix the idea that it is what is called "an exhausting crop" very strongly in the minds of landlords, factors, and farmers; and the consequence is, that to restrict, or even to prohibit its cultivation altogether, is not considered by many to be any hardship. The assertion is taken on all hands for granted, and there is nothing more thought about the matter. As this is really an important point, it will be as well that we give it some consideration before proceeding to other branches of the subject; and although it is not our intention to enter into any chemical comparison of the composition of flax with other crops which are usually cultivated, yet, in order to afford information to those who may feel inclined to compare the composition of the different plants, we shall give the analysis of the flax plant, according to Professor Hodges, Belfast, who has made this matter a subject of special investigation, and who is decidedly the best authority we have regarding it.

Professor Hodges's analysis is as follows:—

Water,	56.64
Organic matters,	41.97
Ash,	1.39
	<hr/>
	100.00

Ash per cent, dried at 212° Fahr., 3.20. One hundred parts of Irish flax-straw give 0.53 of nitrogen. The ash contains:—

Potash,	20.32
Soda,	2.07
Chloride of sodium,	9.27
Lime,	19.88
Magnesia,	4.05
Oxide of iron,	2.83
Sulphuric acid,	7.18
Phosphoric acid,	10.24
Carbonic acid,	10.72
Silica,	12.80
	<hr/>
	99.31

The cultivation of flax has long been a characteristic feature in Belgian agriculture, and certainly the farmers of that country ought to be thoroughly acquainted with its effects on the crops which succeed it. Mr R. Scott Burn tells us in his very interesting 'Notes of an Agricultural Tour in Belgium, Holland, and the Rhine,' which were originally published in this Journal, that "the Courtray district is celebrated for its cultivation of flax;" and he proceeds to say,—

"It is here that the British farmer, generally doubtful of this crop—looking upon it as an exhaustive one, and repaying by small returns the care which its cultivation demands—may study with advantage the peculiarities of that system which makes the Flemish farmer look upon the flax crop as one of the most important, and which, so far from robbing the land of its fertilising properties, adds, on the contrary, greatly to them, and affords in itself the best and strongest inducement to the carrying out of careful culture. Flax cultivation and bad cultivation are indeed quite incompatible. It is impossible to cultivate this crop successfully, not only making it pay in itself, but making it add to rather than take from the fertility of the soil, unless the most careful farming is carried out. This necessitates the lavish expenditure of manure, a close study of its nature, time, and mode of application, the deep and repeated working of the soil, careful and perpetual warfare against the weeds, selection of good seed, and a system of rotation specially designed to meet the nature of the crop."

This may be considered as indirect evidence, at least, that the flax crop is not of that exhausting nature which British farmers generally believe it to be, especially when the rotation is judiciously arranged, and when the land has been suitably cultivated. Ulster farmers are of the same opinion, and they point to the excellent crops of clover which they have on well-cultivated land after flax which has followed a crop of wheat, as sufficient proof that flax does not rob the soil. Nor is this opinion confined to Ulster, for we find Mr Joshua Fennell, a Tipperary cultivator of the crop, giving his experience in the following terms:—"As to its alleged exhaustive properties, thirty years' experience enables me to say that I do not consider it an exhausting crop. On my farm I have had prime crops after flax, and especially when the seed was not allowed to ripen before the pulling of the flax." Our own experience coincides with that of Mr Fennell, and we must confess that our early prejudices were quite opposed to flax culture. A more extended range of personal experience and close observation has tended, however, materially to alter our views; and we do not consider that flax, when cultivated as it ought to be, is more exhausting than the average of our usually cultivated farm crops. It must not, of course, come too close in the rotation, and it must be put in its proper place in the rotation in other respects; but in this it does not differ from other cultivated plants. A frequent repetition of the clover

plant gives us "clover sickness," and a similar course of management in the case of swedes will give us "fingers-and-toes."

But some of our readers may say, We want some other evidence than that of Dutchmen or Paddies to convince us that we are wrong in our idea that the flax crop is a more than usually exhausting one; and as we are anxious to see its value more generally recognised, as well as to show that factors may cease to taboo "lint" in their leases, we proceed to produce some evidence drawn from sources nearer home, and to which more weight may perhaps be attached than to evidence gathered on the plains of Holland, or among the cultivators of flax in Ulster.

In 1851, the Highland and Agricultural Society offered a premium for a report on flax cultivation, and in the Society's 'Transactions' for 1852 three reports will be found on that subject, to each of which a gold medal was awarded. The first report was "by Richard Hodgson, Esq. of Carham, Northumberland;" the second, "by James Farquharson, Esq., Craig House, Kincardineshire;" and the third on the list was "by Mr Walter Reid, Drem, East Lothian." These reports are well worthy of being carefully studied by all who desire to obtain information relative to flax culture in Scotland and the north of England; but we must content ourselves with a summary of the evidence given by those gentlemen, so far as it bears on the question under consideration—namely, the alleged exhaustive properties of flax as a farm crop.

Mr Hodgson says, in the commencement of his report:—

"In the years 1850 and 1851, the portion of land under flax amounted to 5 acres, and to these seasons I therefore confine myself in a statement of the comparative expenditure and produce of that with an equal portion of land occupied by oats. The comparison is perhaps more complete, inasmuch as the rotation has been inverted in these years—viz., flax after oats, and oats after flax—each portion having been previously under the same course of tillage.

"I may be allowed to state that my experience on a smaller scale has satisfied me that, where the land has been fairly treated (that is, kept clean, and compensated by manure for the abduction of the entire crop of seed and straw), *no depreciation of future crops, whether cereal or radical, can be detected*: on the contrary, the depth and accuracy of tillage, and perfect emancipation from weeds, necessary to the successful cultivation of flax, to say nothing of its brief occupancy of the ground (little more than four months), and its independence of artificial aid to moderately fertile soil, may be advanced as bases for the opinion that the *whole* crop, seed and fibre, of flax may be removed with less detriment to succeeding crops than the *whole* of any other crop in ordinary culture; and where the seed, or its equivalent in the shape of manure, is, as it ought to be, restored to the land, few will question the superior efficacy of such a return to that rendered by the straw alone of any of our cereal crops."

This, it will be observed, entirely corroborates the opinions enter-

tained of flax cultivation by Flemish farmers, as expressed by Mr Scott Burn. In another part of his report Mr Hodgson gives the details of a trial he made "to ascertain the value of assertions, frequently hazarded, relative to the noxious influence of flax on succeeding crops, unless counteracted by an unremunerative outlay in manure." Mr Hodgson's land is of medium quality, lying upon limestone and whin rock, at an altitude of 150 feet above the level of the sea. It had been farmed on the five-shift, and the two crops of flax and oats had been grown in 1850 after clover mown for hay. "Neither portion of the land," he says, "appropriated to flax and oats respectively, received any manure in 1850; in 1851 the cropping was reversed, flax succeeding oats and oats flax—the whole being sown with 2 cwt. of Peruvian guano and 1 cwt. of nitrate of soda to the acre." Notwithstanding the manner in which the land had been cropped in the previous year, few weeds appeared on either portion. The application of guano and nitrate of soda did not produce any perceptible benefit in the case of the flax crop, and the net profit yielded per acre by the flax was £3, 1s., which would have been increased by the sum of £1, 16s. expended on guano and nitrate of soda, if that application had been withheld, seeing that it did not produce any perceptible effect on the crop. The oats—*grown after flax*—produced 67½ bushels per acre, weighing 40½ lb. per bushel; 3 bushels of light corn, weighing 36 lb. per bushel; and 48 cwt. of straw; and the yield of oats in this case certainly shows that the previous flax crop had not exercised any "noxious influence" on it.

We now turn to Mr Farquharson's report.

The farms upon which that gentleman's experience of flax cultivation was gained were situated close to the Grampian range of mountains, and from 290 to 350 feet above the level of the sea. The soil on the higher grounds was "a brown light loam, resting on a gravelly subsoil, and quite dry." The "haugh lands" consisted of "alluvial deposits, occasionally interspersed with patches of gravel." The rotation followed extended over six years, grass occupying three years of the course; and the flax was grown in the same division as the turnips and potatoes—that is, after oats, which followed one year's grass cut for hay, &c., and two years' pasture. Mr Farquharson's report includes the details of six years' cultivation of flax. His system was to plough the land as soon as the flax was pulled, then harrow and collect the weeds, after which 24 tons of well-made farmyard dung, "which would have been applied to a turnip or other green crop the preceding spring," was given, "along with 20 bolls of lime," and the land was then sown with wheat—the period between the pulling of the flax and the sowing of the wheat ranging from seven to sixteen days. Grass seeds were sown the following spring, and of both wheat and grass abundant crops were obtained. He says, with reference to one case

where the entire division, where potatoes, flax, and swedes had been grown, and the ground afterwards sown with barley and grass seeds, that

“During the whole season not the slightest difference in the several divisions of the field could be discerned on the barley crop: in fact, it would have been impossible for the most experienced judge to have pointed out where the potato crop left off and the flax crop began, or where the flax left off and the Swedish turnips commenced. The produce, 4 quarters 2 bushels per acre, *was uniform* over the field; and although the average quantity was small, the quality was very superior, weighing $56\frac{1}{2}$ lb. per bushel, and carried the first prize at the Royal Northern Agricultural Society’s Show of Seeds at Aberdeen.

“The young grasses, the following spring and summer, were the finest and most luxuriant ever seen on the farms, and attracted the attention of every one who passed the field. The general belief was, that an extra quantity of seed must have been sown to produce such a flush of grass, but which certainly was not the case.”

It may be observed that Mr Farquharson allowed the seed of the flax crop to come to maturity, believing there is “no good reason why it should not be always ripened and saved,” and this is an important point as bearing on the influence of the crop on those which follow it in the rotation. His views are further stated in the following terms:—

“Flax should always be considered a green crop, and grown on part of the fallow-break, so as not to interfere with the regular rotation, or lessen the usual quantity of fodder on the farm. The seed and bolls, being used for feeding cattle, become a substitute for the turnip or potato crop displaced by that of the flax, and, when so used, keep up the fertility of the soil equally with any other kind of green crop.”

Mr Reid’s trial of flax was made on 10 acres of alluvial clay soil, “with a mixture of moss containing under-water, but tile-drained as deeply as practicable.” The preceding crop was grass, which had been cut for soiling. Half the field, or 5 acres, was sown with flax, and the remaining half with oats. Passing on to that part of the report which refers to the point under consideration, we find it stated that,

“After the flax and oats were removed from the ground in the autumn, the part on which the flax was grown appeared considerably cleaner than the other. At this time the whole received twenty-five cartloads of farm-yard manure per acre. In spring it was drilled up in the ordinary manner for beans, which were sown at the rate of 4 bushels per acre. *During summer the greater luxuriance of those upon the flax ground could be seen at a very considerable distance.* They are now thrashed, and the results will probably surprise those who consider flax as an exhausting crop. The produce and value per imperial acre are as follows:—

"From the ground after Oats."

3 Quarters 1 bushel, weighing 63½ lb. per bushel, at	
80s. 6d. per quarter,	£5 4 3½
161 Stones straw, at 4d.,	2 13 8
	<hr/>
	£7 17 11½

"From the ground after Flax."

3 Quarters 7 bushels, weighing 64½ lb. per bushel, at	
82s. per quarter,	£6 4 0
217 Stones straw, at 4d.,	3 12 4
	<hr/>
	£9 16 4

Difference in value in favour of the crop after flax, £1, 18s. 4½d.

"The beans were sold in Haddington market, and brought the prices attached to them."

These results should therefore tend to dispel any lingering idea that flax is "an exhausting crop," which cannot be grown without serious detriment to the soil. It must, however, be judiciously introduced into the rotation, and not allowed to occur too frequently; but in this, as we have said, it does not differ from other crops usually grown, and about which we hear little dread expressed as to their "exhausting" effects. If, therefore, farmers are willing to grow it, factors may, without fear of consequences, draw the pen through those clauses which prohibit its cultivation, or limit it to a merely nominal extent.

Having thus endeavoured to meet what we have found a serious obstacle in the way when speaking of flax culture to those who were not practically acquainted with it, and whose ideas on the subject were in general derived from hearsay or traditional evidence, we shall now proceed to consider the different steps which must be taken in the cultivation of the crop, and the preparation of it for market: and in doing so we feel it is but justice to give "honour to whom honour is due," for it is to the exertions of the late Royal Flax Improvement Society of Ireland that the country is indebted for much of the information we possess on the subject, and most of the improvements which have been introduced into practice. That Society was founded in 1841, and through its medium several young men were sent to Belgium to learn the details of management prevalent in that country. These instructors on their return taught others, and a large staff of most valuable men was retained by the Society for the purpose of proceeding to any part of Ireland where their services were required, in order to advise farmers regarding the management of the crop. After being in existence for eighteen years, the Society was dissolved in 1859, chiefly, it is alleged, in consequence of its having become rather unpopular, owing to the manner in which working farmers were excluded from taking part in the management. Since 1859 the Chemico-Agricultural Society of Ulster, and the North-East Agricultural Association, the head-

quarters of both Societies being at Belfast, have endeavoured to fill up the blank in so far as the dissemination of information is concerned, but without carrying out the system of practical instruction adopted by the Royal Flax Society. The code of instructions drawn up by that Society, and subsequently revised by a committee of the North-East Association, contains, in small compass, nearly everything which is known on the subject, and is well adapted for use as a guide to those who are in search of sound advice.

The soil best adapted for flax is a deep friable loam, with a strong subsoil. Dryness, either naturally or artificially produced, is essential to the success of the crop; and along with this the land must be in fair condition in point of richness, deeply tilled, and free from weeds. Wet heavy clays are totally unsuited for flax; and although very fine flax can be grown on light sandy soils, the plants are usually short. A great deal of the land in Belgium devoted to flax is, however, of a light sandy nature; but the extreme care bestowed by Belgian cultivators on the preparation of the land, and the manures which they apply to the crop, may in some measure counteract the natural influences of the soil, causing it to produce heavier crops than it would do were those matters less carefully attended to.

The place which the flax crop should occupy in the rotation is a matter of considerable importance. We have seen that both Mr Hodgson and Mr Reid grew it after lea, while Mr Farquharson gave it a place in his fallow-break after lea oats. Mr Hodgson's opinion is, that, "on the whole, after lea, or after a grain crop succeeding lea," is "its most suitable place in the rotation." Irish growers prefer to put it after wheat or oats which has succeeded potatoes or turnips, unless in the case of very poor soils, when it is sometimes taken after potatoes. It should never succeed either potatoes or turnips on land in good, or moderately good, condition. This fact we experienced some years ago, when we knew less about flax, and supposed that coming immediately after well-manured and well-cleaned fallow crops would be much in its favour. But the results in both cases were, that the flax, though heavy crops, was so coarse as seriously to injure its value. When flax succeeds a grain crop which has followed a manured root crop, it is usual in Ireland to sow clover along with the flax. Some object to this, believing that the clover injures the flax; but others, who have paid close attention to the subject, are not of this opinion. The flax occupies the ground such a short time that the growth of the clover must be very luxuriant before any fear need be apprehended of its doing injury to the flax. It will not answer, however, to sow Italian ryegrass in any mixture of grasses sown with flax, for the growth of that plant is too rapid, and it would become intermixed with the flax.

The rotation recommended by the Royal Flax Society, and adopted by the North-East Association, is as follows:—1. Oats; 2. Potatoes

or turnips; 3. Wheat, with grass-seeds sown on half of the break; 4. Flax on half the break, and clover, &c., on the other half, from previous year's sowing; 5. Grass—grass-seeds having been sown along with the flax; 6. Grass. In some of the flax-growing districts of Ulster, where the soil is moderately strong, but rather damp, we find that it is the practice to grow flax after oats which has followed lea, and it is considered essential that the lea shall be two or three years old before being broken up. A light manuring is put on the lea before it is ploughed for oats, it being of the greatest consequence that flax shall not come in immediate contact with ordinary farmyard dung. The flax is then succeeded by turnips or potatoes, which are followed, in their turn, by a crop of oats, with grass-seeds. In the case of flax-culture in Scotland, taking the ordinary courses of cropping into consideration, it is likely that after lea will be found the most generally suitable place for flax in the rotation; and in the event of the lea requiring any assistance in the shape of manure, this will be most beneficially given by putting sheep on the ground in autumn, and feeding them with turnips and cake, before the land is ploughed for the first time.

The main features of the preparation of land for flax have been well stated by Mr Hodgson in his report. He says:—

“The main object to be attained is deep cultivation and a fine tilth, perfect pulverisation of the soil to a considerable depth, and freedom from weeds. The roots of flax will accommodate themselves to the state of tillage, and the straw will be in proportionate height to the depth of the root.”

When flax is to succeed lea, the land should be ploughed early, so as to give it all the benefit of the winter's frost. It will then be cross-ploughed in spring, harrowed, rolled, and again harrowed, and all weeds and the roots of grasses picked off. The grubber will be found an effective implement in reducing the land to a fine tilth, and when all is finished, previous to sowing, the surface should be brought to as level a state as possible. Early ploughing should also be practised when flax succeeds a grain crop; and, to secure thoroughly deep tillage, there are no implements—steam-ploughs not excepted—which will be found to effect it better than the Yester plough and subsoil trench-plough; “the compound action of both ploughs,” as Mr Stephens calls it, mixing and pulverising the soil in a manner which other implements have hitherto failed to effect. The spring ploughings, with repeated harrowing and rolling, accompanied by weed-picking, will also be attended to in this case, as well as when the crop is grown after lea, the object being the same in both cases—namely, the perfect pulverisation of the soil, and complete freedom from weeds. Mr Farquharson's preparatory operations were as follows:—Oat “stubble turned over in autumn; cross-ploughed in spring; harrowed, and weeds collected; deep-ploughed, harrowed, and weeds again collected farther on in the

season ; rolled, and again ploughed—light furrow ; again harrowed and rolled.”

The quantity of seed required to sow an imperial acre ranges from 2 bushels to 3 bushels, $2\frac{1}{2}$ bushels being a fair medium quantity when an average quality of fibre is desired. Thick-sowing gives a fine straight quality of flax, bearing a small proportion of seed, while with thin-sowing the plants grow branchy and coarse, and produce a considerable quantity of seed. When grown chiefly for seed, $1\frac{1}{2}$ bushels per acre will be sufficient.

Flax seed is always sown broadcast, and it should be harrowed in lightly, so that, after rolling, the seeds shall not be covered more than an inch. Some prefer the bush-harrow as best adapted for giving the seed an equal and at the same time a light covering. Riga seed is the best, and each barrel of Riga seed contains $3\frac{1}{4}$ bushels. The seed must be carefully cleaned before it is sown, as it comes to hand in a very dirty state, intermixed with the seeds of weeds, &c. The sieve used for dressing the seed contains 12 bars to the inch, and some prefer a sieve made of perforated zinc, with round holes of the size mentioned, to wire sieves with square holes. Great care is necessary in the selection of seed, and the only safe way is to get it from merchants of character, and not from jobbers, who are apt to play tricks with the seed which comes through their hands. The respectable merchant will charge a higher price than the other, but the higher-priced article will be found worth far more than all the difference between it and one which is lower-priced but inferior. Good seed is plump, shining, and heavy, and there are well-known “brands” in the market which are in themselves a sufficient guarantee of the quality of the seed. Dutch seed does not produce as heavy crops as that obtained from Riga, but the fibre produced by Dutch seed is usually finer.

When the sowing of flax is finished, the field should have a clean, uniform, level surface, with the soil reduced to such a state of tilth that it may be said to resemble an onion-bed.

Flax should be sown in April, as early in the month as the preparation of the land can be finished. At the same time good crops have been grown when the sowing was deferred until the first week in May ; but, as a general rule, we prefer the middle of April, when the weather and state of the land is suitable.

From what has been said, it will be seen that flax does not succeed well when coming in close contact with rank dung. The land, indeed, must be sufficiently rich, but the fertilising matter must be thoroughly incorporated with the soil, in order to produce a good crop of flax. At the same time it may be necessary in some cases to apply artificial manures ; and the following mixture has been recommended by Professor Hodges as a suitable dressing for an acre of flax land, to be scattered broadcast, and covered with the harrows before sowing the seed :—

30 lb.	muriate of potash.
28 "	chloride of sodium.
34 "	burned gypsum, powdered.
54 "	bone-dust.
56 "	sulphate of magnesia.

202 lb., costing about half a guinea an acre.

We have seen that an application of 2 cwt. of Peruvian guano, and 1 cwt. nitrate of soda, produced no perceptible effect on Mr Hodgson's crop; he considered it, in fact, "to have been a superfluous and unremunerative expenditure." We are aware, however, that superphosphates have been applied to flax land, before sowing the seed, with marked benefit to the crop; and that common salt has also produced more abundant crops of flax than those obtained from land where salt was not applied. The quantity of salt to use in this case is from 6 to 8 cwt. per imperial acre, and it must be scattered over the land a fortnight before sowing, and either covered by the harrows or by a light furrow. From 30 to 40 bushels of soot per acre have also been applied with benefit; and it, too, is covered by the harrows before the seed is sown. Flemish farmers use liquid manure, either in its natural state, as collected from the stables and cowhouses, or mixed with rape-cakes, which have been added to the liquid eight or ten days before the manure is applied to the soil—(R. S. Burn.) The liquid manure is applied after the land has been worked sufficiently preparatory to sowing; and, after harrowing, the sowing is then proceeded with, or the last-named operation is deferred for some days. There is little doubt but that the regular and judicious application of carefully prepared liquid manure has been a great means of enabling the naturally poor soils which are found in many parts of Flanders to produce the superior crops of flax, as well as of other plants, which we find yielded as the results of Flemish husbandry.

When the young flax plants are five or six inches high, the field must be carefully gone over for the purpose of taking out any weeds which make their appearance. If the land has been well cleaned beforehand, there will not be many weeds in the crop; still this operation should never be neglected, nor should it be delayed until the plants are taller than we have stated, as they would, in such a case, be more liable to injury. The weeding is done by women and children, without shoes, or in list slippers—heavy nailed shoes being most injurious to the tender plants—and the weeders creep along on their knees, having a coarse cloth or small straw mat to protect the knees, and baskets into which the weeds are put. They must work always one way so as to face the wind, which enables the plants to recover their upright position. The greatest care must be observed not to twist the plants, for if this is done, they never rise again, and are lost.

Mr Charley, whose treatise on 'Flax and its Products' may be

regarded as a standard work, not only with reference to the cultivation of flax, but the various manufacturing processes through which the prepared fibre passes, expresses himself in the following somewhat enthusiastic terms relative to the crop during its summer growth:—

“ We will now imagine the crop in full growth, and approaching maturity ; the field in the distance appears a mass of soft and elegant green, undulating in long waves when under the pressure of the breeze ; approaching nearer, we see that every stem is crowned with bright blue flowers of most delicate texture, and beautifully formed. At this stage there is no crop the agriculturist produces that can equal flax for ornamental aspect ; in a few weeks, however, the field becomes changed, and instead of the handsome flowers we find rough-cased globules full of seed.”

The crop is ready for pulling—that is, when fibre is the object—“ when the seeds are beginning to change from a green to a pale-brown colour, and the stalk to become yellow for about two-thirds of its height from the ground”—(Royal Flax Society.) This will take place from about the end of July to the end of August, according to the time when the seed was sown, the season, and the situation. Sometimes the crop is not ready to be pulled until the first or even the second week in September, but this is generally too late. When seed is the principal object in growing the crop, the flax is not pulled until it comes to full maturity. In this case, the fibre is coarse. If a more than average fine quality of fibre is wanted, the crop must be pulled even sooner than we have mentioned ; and the Société Linière of Brussels, in its printed recommendations, quoted by Mr Charley, says on this point:—

“ It has been proved that when the flax is pulled *between the falling of the flower and the formation of the seed*, the fibre is finer and more solid than at any other time ; so that, unless it is wished to sacrifice the quality of the flax to obtain seed, the former must not await the full maturity of the latter.”

But the Royal Flax Society warns us that, if we pull the flax too soon, the great waste which attends the scutching and hackling of such a fine quality of fibre renders it unprofitable ; so that it is better to avoid this by deferring the pulling until “ the seeds are beginning to change from a green to a pale-brown colour.”

Fine weather is essential when the flax crop is pulled, and the operation requires considerable care to do it properly. In pulling, a handful of the flax is drawn out by the puller, who grasps the flax underneath the seed-bolls, and by this means the short poor flax produced by the second growth is left behind. This may be pulled afterwards, but it must be kept entirely separate from the other, and we have never seen it worth while being at the trouble to save it. If any of the flax is laid, it must be pulled sooner than the rest of the crop, and kept by itself. The root-ends of each handful

must be kept even, "like a brush;" and as the flax is pulled, the handfuls are laid across each other, which keeps the bolls separate.

The rippling process is carried on simultaneously with the pulling. There are many, however, who make up their flax for the steeping-pool at once without rippling, or taking off the seed-bolls, alleging that the cost of rippling is more than the profit, and that the fibre of flax which has not been rippled is better than that which has been subjected to this process. In fact, a person who has grown flax rather extensively said to us lately, that "ripping is one of those things which looks well on paper, but does not answer in practice." To this it may be answered, that if the flax is not over-rippled—that is, if we are not too anxious to obtain a large quantity of seed—the value of the fibre is very little injured by the process; and the value of the seed is such, simply for feeding purposes, that the cost incurred is well repaid. Mr Charley expresses his belief, that "for every £1 expended" on rippling, an average return of £2 is realised; and that even this "estimate of cent per cent profit on the outlay of rippling is under the mark."

The handfuls of pulled flax are carried directly to the rippers, who work in the field where the pulling is going on. The rippling apparatus consists, first, "of half-inch square rods of iron, placed with the angles next the rippers, 3-16ths of an inch asunder at the bottom, half an inch at the top, and 18 inches long, to allow a sufficient spring, and save much breaking of flax. The points should begin to taper 3 inches from the top."* Three iron teeth are screwed into a block of wood, which, in its turn, is fastened by screws across the centre of a 9-feet plank, the ends of the plank being raised from the ground by short feet, or by stools placed underneath. Two rippers sit on each plank facing each other, and a large winnowing cloth is spread on the ground under the rippling apparatus to catch the bolls. We shall let the concise directions of the Flax Society describe the rest of the operation:—

"The sheaf is laid down at the right hand of the rippler, and untied. He takes a handful with one hand, about six inches from the root, and a little nearer the top with the other. He spreads the top of the handful like a fan, draws the one-half of it through the comb, and the other half past the side, and, by a half-turn of the wrist, the same operation is repeated with the rest of the bunch. Some, however, prefer rippling without turning the hand, giving the flax one or two pulls through, according to the quantity of bolls. The flax can often be rippled without being passed more than once through the comb. He then lays the handfuls down at his left side, *each handful* crossing the other, when the sheaf should be carefully tied up and removed. The object of crossing the handfuls so carefully, after rippling, when tying up the beets for the steep, is, that they will part freely from each other when they are taken to spread out

* Royal Flax Improvement Society's Report.

on the grass, and not interlock and be put out of their even order, as would otherwise be the case."

It will be observed that, as there are two rippers at work on each plank, they must strike the rippling comb alternately and regularly, so as to prevent confusion.

The bolls are first put through a coarse riddle, and afterwards through fanners, and spread thinly in a loft to dry, the windows being left open, and the bolls turned thoroughly, at least twice a-day. The drying process may be hastened or finished by putting the bolls on a kiln, observing that the heat is kept very mild, so as not to dry them too rapidly. Before giving them to cattle, they should be crushed in a mill, allowing the chaff to run through with the seed, and the stones will be kept clean if a quantity of oat "seeds" or husks are mixed with the bolls while being put through the mill. The chaff of flax bolls ought not to be thrown away, for it is an excellent ingredient to mix with boiled or steamed food for milch cows.

As soon as the flax is rippled, it must be firmly bound up in small sheaves, and carried at once to the steeping-pool, or "lint-hole," as it used to be called in Scotland. The best tying material is rushes; but as these are now scarcely to be found in some districts, and will, we hope, become more rare every year, it may be stated that bands made of the flax itself will be found to answer the purpose, while others use straw bands or hemp string for tying the sheaves.

But as there are some who may not wish to steep their flax immediately after it has been pulled, we shall, before describing the steeping process, state what must be done to harvest the crop when immediate rippling and steeping are not contemplated.

In this case "the Courtrai system" must be followed. The flax, by this system, is tied up in small sheaves—the tying being put nearer the top than the root-ends, and the lower part of the sheaf is spread a little, as the sheaves are set up in stooks. While the stooks are drying, they should be carefully watched, and in case of any sheaves falling down, they must be at once set up, to prevent discoloration of the fibre, which would ensue if the sheaves were allowed to lie long on the ground. "Hood-sheaves" are not required. When the sheaves have become perfectly dry—which will be hastened by turning them once or twice during the time the stooks are left standing—they may be formed into larger bundles, and then built up in a stack. The usual form of these stacks is a narrow oblong, the root-ends being laid on the outside, and the stacks must be raised from the ground, in order to prevent mice from getting into them. We have put up flax in oblong stacks of considerable size, but taking the precaution to set up at least two of the ordinary triangular "bosses," made of rough timber, such as larch poles, by which means the stacks were thoroughly ventilated. During winter, the flax is carried to the barn and the seed taken off. This is sometimes

effected by "striking the heads with a beater made of a rectangular piece of wood, and provided with a curved handle on the centre"—(Burn); but it may also be done by means of a thrashing-machine, the feeding-rollers being put out of gear, and the sheaves so held that the beaters on the drum shall merely strike off the bolls, the sheaves being then withdrawn, and not allowed, of course, to go through the mill. This done, the sheaves must be carefully handled, made even at the ends if in any way disarranged, firmly re-tied if necessary, and either rebuilt in a stack or in a spare loft, where it will remain until May, when it may be steeped and otherwise prepared for market.

This, therefore, brings us back to the subject of steeping—one of the most important points in the management of the flax crop. Green flax, as we have said, is carried at once to the steeping-place, after being rippled, or without being subjected to that operation, according to the old-fashioned mode, and made up into sheaves. The construction of the steep-pools, and the nature of the water used, first claim our attention.

Ample materials have been placed at our command for a proper consideration of this important department of the subject, in an excellent paper read at a meeting of the North-East Agricultural Association last November, by the Rev. Joseph Bradshaw, a member of the Special Committee of the Association for promoting the growth of flax in Ireland, and a gentleman who has devoted much attention to all the details of flax cultivation. The following, therefore, is chiefly a summary of Mr Bradshaw's directions relative to the construction of the pool, the steeping of flax, and the water to be used for this purpose.

Mr Bradshaw recommends all who intend growing flax for the first time, to prepare the pool during the previous winter, when other work is not pressing, and not to leave it, as some do, until the flax is ready for pulling. The situation of the pool is a matter of considerable importance. It must be selected so as not only to have the command of a sufficient supply of good water, but also warmth; and it must be noticed, that if the situation is in the vicinity of trees, these must stand on the north side of the pool, and not in such a position as to cast a shadow upon it at any time of the day. This is more particularly of importance when, from late pulling, the crop is not watered until September, when fermentation is much more readily retarded than it is in August, when the weather is warm and the sun high. So convinced is Mr Bradshaw of the importance of situation, that he says that, should the richest land on the farm be the best point where to construct a steep-pool, no man who grows flax ought to hesitate to take it, as the extra value of the flax watered in such a situation, as compared with that which has been prepared in a pool made in an inferior spot and possessing a worse aspect, will do more than pay the difference.

The width of the pool depends on circumstances. If there is access for loaded carts on both sides, it may be constructed from 14 to 16 feet wide; but if access can be had only on one side, from 8 to 10 feet must not be exceeded. The proper depth is about 4 feet on level ground, but if the ground is sloping the depth may vary from $4\frac{1}{2}$ feet at the lowest end to 3 feet at the upper. The length of the pool must be regulated in some measure by the extent of crop grown on the farm; but Mr Bradshaw lays it down as a rule, that "no pool should be larger than can be filled in the same day; for it must not be forgotten that the flax first put in is last taken out." When a considerable extent of flax is grown, there must, therefore, be several pools, or a long pool can be divided, by "placing a few stakes across, and ramming in sods and clay above them," so as to form a dam or weir at any point. The sides of the pool should be sloped a little, and loaded carts must not be permitted to come close to the edge. Keeping the pools always full of water will help to prevent the sides being injured by frost; but, with every care, it will still be necessary to dress and pare the sides slightly every season. The land on each side of the pool must be thorough-drained, the drains being cut as near the sides as possible, but not so near that either the water from the pool shall find access to them, nor yet that from the drains find its way into the pool. Where the soil is porous, it will be necessary to cut "a deep and narrow trench parallel to the sides, and some 3 or 4 feet from them, running the whole length, only turning it into the side at each place where a weir or dyke is put across, so that each pool may be watertight;" and this trench is to be rammed full of clay.

The best kind of water for steeping flax is pure soft water, free from iron and all other mineral impurities. Iron is most injurious to flax; and bog-water, though frequently used, is by no means desirable. Hard spring-water, and water from drains, should be avoided—flax taking longer to steep, besides being less equally steeped, where such water is used, than it is when soft water only is admitted to the pool. Stagnant water is not considered so good for flax as a running stream; and Mr Bradshaw states that "a small stream, say about the thickness of a man's wrist, passing through the pool, carries off the dark fetid water, and is considered to improve the quality and colour of the flax." In this he agrees with the directions of the Royal Flax Society, as revised by the Committee of the North-East Association. In the Courtraï district the flax is steeped in the river Lys, the water of which is very pure; but river-steeping would not answer in the British islands, seeing that the fermentation of flax, caused by steeping, is fatal to fish.

Putting the sheaves of flax into the pool is an operation requiring some nicety to do it properly. Where the water can be admitted to the pool at pleasure, Mr Bradshaw considers it desirable to put in the flax before the water is let on. In general, however,

the pool is filled before the flax is put into it. Begin at the lower end, or where the water is deepest, and put in the flax in regular rows across the pool, "with the root-end down, resting on the bottom, and standing nearly upright." The Flax Society directed that the flax *beets*, or sheaves, shall be placed loosely in the pool; but Mr Bradshaw differs from this view, and insists that they shall be packed pretty tight all through—his reasons being, that tight packing economises space, while it does not appear to affect the fermentation of the flax; and besides, that it prevents the flax, when it begins to ferment, from casting off the sods or stones which have been placed on it. These sods or stones are put in equally all over the flax, for the purpose of keeping it under water, and the pond must be often examined while the flax is being steeped, for the purpose of replacing any which have fallen off. When sods are used, they are put with the green side next the flax. A light covering of straw is also used, with stones to keep it down; and where straw is scarce, rushes or ragworts are substituted. As the fermentation proceeds, additional weight must be put on the flax, for it is unadvisable to allow any portion of it to rise above the surface, so as to be affected by air or light. A good plan to keep the flax equally under water is, to lay wooden hurdles on the top of the sheaves, and then sinking these by stones placed on them. When fermentation ceases, all weight, except so much as may be required to keep the flax merely under water, without sinking it to the bottom, must be taken off.

The next point to be ascertained is, when the flax is sufficiently watered—that is, neither over-steeped nor under-done. This period varies; but if the weather is warm, much less time is required than is necessary when cold nights check fermentation. Hence the impropriety of allowing the steeping process to remain until late in the season, as must be the case when the sowing of the seed has been more than usually late. In such cases, and in high-lying districts, where the nights soon get cold and even frosty, it would often be better to defer the watering until May, than to run the risk of imperfect steeping late in September. Sometimes the flax is sufficiently steeped in six days; while, in other cases, it may require from twelve to fourteen days, and even more, to finish the operation. Mr Bradshaw is very minute with reference to this important point. He says—

"As a wise physician will take care to gain all the information he can from the patient or his friends before he draws conclusions about the symptoms of the disease and the remedies to be adopted, so a prudent farmer will take a great many things into consideration before deciding upon the indications of the one great test—whether, for example, the flax grew well, and is a good sample of a healthy, strong fibre; whether the weather is very warm; the steep-pool favourably situated, filled with nice soft water, free from all deleterious matter, such as lime, iron, or lead ore;

whether fermentation set in immediately, and worked well and violently, and then as quickly and quietly subsided. And if he knows that all these things have occurred, he concludes that he ought to be very watchful. He examines on the seventh, or, at the farthest, on the eighth day, in the following manner: Having removed some sods or stones, as the case may be, about the middle of the pool—middle, as regards both ends and sides—he pulls up a beet (or sheaf) as gently as possible, and places it on the edge, and, in doing so, notices whether the seed-bolls drop off freely; he then gives it a good shake at the end, and if all the seed drops off completely, he concludes this to be one favourable sign. He next grasps as much as he can hold firmly in his hand, and if it feels soft, clammy, and compliant, and does not separate when he opens his hand, but, on the contrary, that it sticks well together, as if half-glued, requiring a little force to separate the stalks, he concludes this to be another favourable symptom; and then proceeds to the final and important test, by taking some six or eight stems out of the centre of the beet, and bending them rather sharply over his forefinger, holding the end firmly with his thumb. If the stem breaks under this operation, and the shove or inside part starts out like a broken bone, he concludes that the flax is done. It will almost invariably be found that, in applying this last test, the stem will be brittle at the root-end first, and get less and less so as you approach the seed-end. It is best, therefore, to begin at the root and proceed upwards, and if you still find it brittle to the middle of the stem, you may be sure it is done. I need scarcely say that the opposite, or a modification of all or any of these indications or tests, would point out that the time had not arrived for taking it out. It should be examined morning and evening until found ready."

When the tests mentioned by Mr Bradshaw show that the flax has been sufficiently steeped, take off the sods, stones, &c., which have been used as weights, and lift out the beets carefully to the bank. The flax is then taken to the spread-ground, which should be a piece of clean grass-land, closely mown, and sheltered from high winds. The flax is spread "evenly and thinly," in rows; and after lying a few days in this way, it must be turned carefully over, which is done by means of long light rods, so that it may be bleached equally on both sides. The time required on the grass will vary from eight days to a fortnight, under-watered flax requiring more time than that which has been thoroughly done in the steep-pool. Showery weather also hastens the *grassing* process. When a large number of the stalks assume the form of a bow and string, the flax may be considered as ready to lift; and in doing so, it must be kept straight and even, to prevent subsequent loss in scutching. It is then tied up in small bundles, and either taken to the scutch-mill as soon as possible, or put up in small stacks, built so as to have a free circulation of air through them, and then scutched as convenience permits.

Other modes of steeping have been invented, but, as Mr Charley states, the spinners "still prefer the old watering process to any yet

discovered ; not from prejudice or partiality, but from the acknowledged superiority of flax prepared in that way to any other in the *spinning quality* so much esteemed. The two most important systems of artificial retting are those introduced by Mr Shenck and Mr Watt ; the principle of the former

“ Consists in substituting for the irregular action of the out-of-door watering-pools the certain and regular effect of water heated to a given temperature under cover, so as to hasten the desired fermentation necessary to separate the pure fibre from the gummy and woody portions. The water is heated by steam in the vats containing the flax, and any temperature required can be easily attained ; about 80 or 90 degrees Fahrenheit have been found the most suitable, and the entire time occupied does not exceed sixty or seventy hours.”—(*Charley.*)

Mr Watt's system is founded on different principles from that of Mr Shenck's, boiling and crushing being substituted for fermentation :—

“ In Watt's rettery the flax is placed in an iron steam-tight chamber, with a cistern on the top to act as a condenser. The steam is introduced at the bottom ; it heats and softens the flax, and being condensed to water on contact with the roof of the chamber, falls down again, washing the flax thoroughly on its way. After undergoing this process for from twelve to eighteen hours, the flax is removed, and immediately passed through between heavy rollers, by the action of which it is pressed nearly dry, and is so flattened as to lessen the adhesion of the epidermis to the woody and fibrous portions of the plant, and thus makes the cleaning that must follow a more easy operation. From the rollers the flax is transferred to the drying-rooms, of course heated by steam, and after this it is ready for the scutching process.”—(*Charley.*)

In such cases farmers merely grow the flax and save the crop, which is purchased either in the green or dried state by parties for further preparation in those retteries. But although the old mode of watering still prevails in Ireland, the hot-water system of retting is followed in England—as in the case, for example, of the Patrington Flax Company, which carries on its operations near Hull. That Company has tried to persuade those farmers who grow flax in that district to thrash off the seed and sell the straw by itself, but in most cases they persist in selling the crop as it grows on the ground. The establishment of retteries on the hot-water system would undoubtedly do much towards promoting the cultivation of flax in Great Britain, particularly where any dislike to it might exist arising from the manipulation required where steeping, grassing, &c., are done by those who grow the crop. But unless the growth first took place, no one is likely to run the risk of establishing works as a trade speculation. If, however, a few intelligent farmers would commence to grow the crop, and manage it entirely for the profits they would derive from the sale of the straw to the retteries,

and the use of the seed for feeding purposes, then individuals would be found to embark capital in such works; for the supply of fibre is of so much importance, that spinners, for their own sakes, would readily assist in doing all they could to introduce or extend the cultivation of a crop which is so essential to their interests as flax unquestionably is.

Considerable improvements have been made in scutching machinery, but there is still too much waste in many of the mills in use, and parties of long and extensive experience in the business believe that a really good description of scutching-mill, which will economise cost and prevent waste, is much wanted. The Messrs Rowan, Belfast, brought out three years ago a new scutching machine, which they have patented, and the advantages of which are, that it is portable, cheap, produces more fibre than the old mills, and is so simple that any ordinary farm-labourer can easily acquire sufficient knowledge of it to work it properly. The flax prepared by it is not considered, however, so mellow as that done by the old mills, and for this reason is not so well liked by spinners. But it is likely that the inventors will rectify this, and in that case Rowan's machine will become extremely valuable, for it only costs £24, and can be driven by the ordinary gearing of a thrashing-mill.

Another recent invention of American origin has been tried and approved of in the neighbourhood of Belfast. The machine we allude to is Sandford and Mallory's patent brake, for preparing the flax straw for the operation of scutching, which it does in such a manner that the subsequent scutching is performed in less time, and produces a greater yield of fibre, than is obtained when the breaking is done by other machines. This "brake" is simple and portable, not weighing over 10 cwt., and not occupying more than 5 feet square, and requiring less than one horse-power to drive, and no skilled attendance. It will break from 20 to 30 cwt. of straw per day. The trials made, so far, have been satisfactory.

Mr Andrew Potts, residing near Banbridge, in the county of Down, has also recently patented a "self-acting scutching machine," which is well liked by several parties who have tried it. As yet it is comparatively in its infancy, and it has been suggested by some competent judges that a want of mellowness in the fibre, which appears to be produced by all new machines, might be got over by uniting the American brake with Mr Potts's scutching machine, so as to combine the merits of both.

The following description of his machine has been supplied by Mr Potts:—

"This machine dresses thoroughly from 5 to 6 stones per hour; one girl gives the rough flax into it, and another receives it at the opposite side of the machine quite clean. It gives much more yield of fibre from a given quantity of rough flax, than can be had from the common mill, as

has been often proved by farmers. The power required is, we believe, about the same as is used to clean the same quantity in the same time by the common mill. It requires no skilled labour ; any two expert girls can attend it without the least difficulty, and are not exposed to any danger. If the machine be driven by water, the entire expense of scutching to its owner is 3½d. per stone of 14 lb. dressed flax, leaving a net profit about double per stone that obtained by the owner of the common mill.

“The cause of so much difference of yield in favour of this machine is, that there is very little tow made by it. The flax it dressed has been tested, and found to give fully seven per cent more yield off the hackle than mill-scutched flax : the reason is, it is free of lumps, matted or crossed fibres, catches, broken or cut fibres, and fibres chaffed or made cotton-like, and leaves the fibres not entangled, but free and parallel from end to end. Farmers find they can realise more money for their flax when dressed by this machine, and consequently their pressing demand here for scutching can scarcely be accommodated.”

We have thus endeavoured to lay before the readers of this Journal the details of what cannot fail to be considered an important crop, whether as regards the interests of the grower or of the manufacturer. It is true that the cultivation of flax requires a close degree of attention to insure success, but we cannot think that this should be any obstacle to an extension of its cultivation among the enlightened and enterprising farmers of Great Britain. Such might, indeed, be the case at a period when they “couldna be fashed” to do many things, even if they knew them, which are now matters of daily occurrence, and without due attention to which they are well aware they could not get on. In fact, the trouble attendant on flax cultivation is often much exaggerated ; and we maintain, from our own experience of it, that, with ordinary care, any one may soon become so well acquainted with the details, that there would be no more risk in growing it than in growing any other crop. And we take this opportunity of saying, that its introduction, or rather the revival of its cultivation, in the Highlands and Islands of Scotland, would be very advantageous to the people of those districts. But while we are of this opinion, we should also desire to see flax more generally cultivated throughout Scotland and England than it is at present, being fully convinced that all classes would be permanently benefited thereby : and such being our views on the matter, we close our remarks with an appropriate quotation from Mr Charley’s excellent work, to which we have frequently referred in the course of this article.

“Too often the profits of the flax crop have been overrated, and much disappointment caused thereby among parties who tried the cultivation with only moderate success. With ordinary care, a fair profit may always be expected, while *occasionally* a larger sum may be realised than by any farmer’s crop grown in Europe. I mention this that novices may not be misled into the idea of making fortunes *all at once* by flax cultivation ; what

I hope is to see it introduced by every agriculturist in Great Britain as a portion of the *regular rotation* on his farm ; and if one-twentieth part of the good arable land in the kingdom was thus regularly under flax, we would be quite independent of any foreign supply, and would possess a stock of *fibre* and *linseed* that would in many ways contribute to the benefit of both the manufacturing and agricultural interest."

RETROSPECTIVE NOTES ON FARM CROPS AND CROPPING.

No. III.

WE now come to the practical management of the wheat crop on various soils ; and on this important subject we shall give a few notes culled from various quarters. The first paper we refer to is one on the "Management of Wheat," by Mr Ed. Roberts, in the 'Journal of the Royal Agricultural Society.' As regards the nature of the soil on which wheat may be grown, it may be said that, while it may be grown upon nearly every description of soil, those which are best adapted to it are those more or less clayey. Heavy lands are, indeed, generally classed as wheat lands. But if the preparation of the land is properly attended to, wheat may be grown to the greatest perfection upon almost every soil. But while each variety of soil involves some different mode of preparation, there are certain points which must be attended to in all soils. These essentials are, first, "thorough drainage;" second, "complete cleaning from weeds;" third, "proper rotation of cropping;" fourth, "judicious manuring;" and fifth, "an entire change of seed from hot land to cold, and from cold land to hot:" this change of seed will always be advantageous, and especially from hot to cold soil, in which case it will frequently bring the harvest a week earlier.

Wheat is generally taken after clover, the roots of which becoming decomposed yield nutriment to the wheat plants ; while they give that solidity to the soil which the wheat plant requires for its healthy development. It has sometimes been noticed that where the clover plant has failed the wheat plant succeeding it has failed also. These instances do not often occur ; where they do, they show an adaptation of the two plants to each other, or a mutual sympathy which justifies the correctness of the practice so generally followed of making the wheat follow the clover. We have said above, that according to the nature of the soil so is its management. We purpose now to bring under review the various classes of soil, with the management which their peculiarities involve ; and, first, as to

Clayey soils.—Upon these soils a full summer's fallow is occasionally resorted to as a preparation for the crop, more especially when

the land has got into a foul state with larch grass, &c. &c., and to which cleanness cannot be restored with the partial fallowing which is available through the growth of green crops, &c. It is also to be noted that this thorough summer fallowing has a good influence upon the soil, as it allows the atmospheric influence to more perfectly decompose its constituent parts; so much so that in some instances it has been noted that more advantage has been obtained by giving a thorough summer's fallow without manure, than by a partial fallowing with a plentiful supply of dung. On the heavy lands of the midland counties, where a summer's fallow is followed, the land towards the end of July or beginning of August is thrown up into two out-stitches—after, of course, it has been thoroughly pulverised and cleaned from weeds—one yard wide, and manured with 8 to 10 cartloads per acre, precisely as if for the turnip crop; others spread the manure over the land, and plough it in so as to have the stitches or furrows from two to eight yards wide. In both of these cases the land should remain untouched till the time of sowing, although it often happens, where the latter mode is practised, that the weeds come up so strong that, before sowing, it is necessary to cut them up with the horse-hoe, as the harrow would be ineffectual in removing them. Where the former method is adopted, the plough alone is sufficient to remove the weeds. The seed is sown under the furrow in what is called the "spraining system;" one seedsman sowing to two ploughs, the ploughs merely reversing the furrow formerly dunged. The seed should not be sown when the soil is too dry, or in a dusty condition, as the young plants are in this state of soil apt to become "root-fallen;" and even where the soil is of a closer texture, and this is not likely to happen, wheat does not flourish so well as when put in after rain. Indeed, Mr Roberts says that land cannot be too wet for sowing wheat, provided it works kindly and the seed can be well covered. There are, however, some soils of sandy clay which should not be worked or stirred while wet, as they will run together and form a hard crust of soil through which the young plants have a difficulty to penetrate. The best period for sowing on soils of the kind now under description is from the last week in September to the middle of October; the plants rarely become winter-proud in soil of this description. We have said that under-draining is one of the essentials required in all soils; some maintain that, this being attended to on clayey soils, there is no necessity for upper water-furrows. Mr Roberts says that he thinks this a mistake, for he finds that upon soils of this nature the surface water does not go off sufficiently quick without it.

Where land of the kind now under consideration, clayey or tenacious, has been got into a high state of culture, it is frequently made to carry a crop of turnips or mangolds. That these crops cannot always be got off the land is true, so that spring wheat has to be sown upon it, and the seeding delayed till January or

February; while turnips grown upon the fallows, and fed off during October and November by sheep, is an excellent preparation for wheat on clayey soils in high condition. In cases where this plan is adopted the following is the rotation :—

First year,	.	.	.	Fallow for turnips.
Second year,	.	.	.	Wheat.
Third year,	.	.	.	Beans or pease.
Fourth year,	.	.	.	Wheat.

The next round being—

Fifth year,	.	.	.	Fallow for swedes.
Sixth year,	.	.	.	Barley.
Seventh year,	.	.	.	Clover.
Eighth year,	.	.	.	Wheat.

Wheat on clay soils is often sown after beans, the dung is applied to the beans, and the crop well hoed, so that the land is clean for the wheat, hence the advantage of sowing the beans in drills. This plan of dunging the land for the beans is better than dunging the land directly for the wheat, which practice often is a cause of blight. By having an intermediate crop of beans the blight is likely to be prevented, and a better crop both of beans and wheat secured. Where farmyard dung is scarce, and cannot be applied to the beans, rape-cake at the rate of 8 to 10 bushels per acre may be drilled in at the sowing of the wheat. On the heavy clay lands of Norfolk and Suffolk the wheat follows either clover or beans and pease, barley being the crop immediately succeeding the fallow, so that the rotation stands thus :—

First year,	.	.	.	Fallow.
Second year,	.	.	.	Barley.
Third year,	.	.	.	Half clover, half beans or pease.
Fourth year,	.	.	.	Wheat.

The best farmers apply dung to the pulse, carefully hoeing the crop. The wheat is drilled after the beans, although by some it is drilled after the clover. The clover layers are manured heavily with farmyard dung, either on the young plants during winter, or a short time previously to turning over the land for wheat; the wheat comes kindlier, and the clover plants are benefited by the plan of dunging the clover in winter. It may certainly be objected to this system that the manure is exposed all the winter to the atmosphere, and that much of its fertilising properties may be wasted; on the other hand, it may be said that the clover will take what its growth specially requires, leaving the other constituents to be assimilated by the wheat. This system of grain-growing, as practised by the best farmers of Norfolk and Suffolk—the parents *par excellence* of the “drill husbandry”—might be followed with advantage in other districts of England, where the furrows or stitches are wide, and brought up to an enormous height in the centre by repeated plough-

ing. This absurd form and width of the furrows brings about many disadvantages. The grain is always of unequal quality, being very inferior towards the furrows as compared with that at the crown of the ridges; and from the width of the stitches, the horses tread upon and poach the land very much. In Norfolk and Suffolk the stitches are flat or but slightly rounded, and are of such width that the drill takes the stitch at a bout, while the horses, in this as in all the succeeding operations of harrowing, &c., walk invariably in the furrows, so that all treading on the land is avoided. Those farmers who love the high-backed furrows should remember, or, if not knowing, should be made acquainted with the fact, that the raising of grain crops on the flat is the tendency of improved agriculture.

Light chalky or gravelly soils.—On soils of this kind the wheat crop generally follows the clover or trefoil. Should the clover fail, a crop of early pease is substituted; and on these being removed, coleseed or tares or white mustard is laid down and eaten off by sheep in the autumn. The land thus prepared succeeds well with the wheat. To prevent the wheat plants being thrown out, or the ravages of the wire-worm, the soil is consolidated either by the use of the roller or by treading with folded sheep. Light soils are greatly improved by being mixed with clay, and the process is considered essential where a good crop is desired. Light lands require more seed to the acre than heavy soils, and the end of October is the best time for sowing. In light soils, 10 pecks to the acre is not an unusual quantity.

Rich, deep, loamy soils.—Wheat, in soils of this kind, is successfully cultivated after potatoes; the potatoes being got off the ground not later than October. In many districts, as in Eastham, Rumford, Barking, Edmonton, Enfield, &c., it is no unusual thing to grow potatoes and wheat alternately for many years. And we may note, that we have seen the practice adopted in the north of England with remarkable results. But where this species of what may be truly called hard cropping is followed, it is necessary to manure the potatoes very liberally. The potatoes may then yield 300 to 500 bushels per acre, and the wheat from 30 to 40 bushels. Four pecks of seed per acre, on this quality of land, will be sufficient, and care should be taken not to sow it earlier than the end of October or the beginning of November; as, if it is sown earlier, the plants are almost sure to become winter-proud. Where a rich strong loam contains a larger proportion of clay, wheat and beans may be and are sown alternately, and successfully, too; in some cases where the beans are kept perfectly clean by repeated hoeing, ploughing the land for the wheat is often superseded, all that is required to be done being to harrow the land previous to dibbling or drilling the wheat.

Peaty soils.—To enable soil of this character to bear wheat, it must first be thoroughly drained, so as to get it in some degree consolidated; thereafter it must be mixed with clay or inorganic

matter, and well treaded, rolled, and pressed before and after sowing. In the fens of Lincolnshire and Cambridgeshire, where peaty soils are thus improved, the improvement in the quality of the wheat keeps pace with that of the land, approaching that grown on sandy and loamy soils; while the quantity greatly exceeds that grown on light sands or gravels. A process which appears adapted for the preparation of peaty soils for wheat is, to plough the land shallow, drill, roll, and hand-dibble the seed in the grooves made by the roller, finally covering the seed with a harrow. Solidity of soil is absolutely essential in peaty soils. Dibbling the seed, giving as it does a stiff straw, appears to be the best adapted for peaty soils.

Fresh-broken-up grass-land.—On this land oats are preferred to wheat as the first crop; but when the surplus vegetable matter of the soil has been reduced by burning, tillage, and the mechanical application of suitable earthy matter, wheat can be grown of good quality. In concluding the remarks upon the various soils, let it be remembered that, in all soils prepared for wheat, it cannot be too stale or solid, provided it be free from weeds, and the surface soil sufficiently pulverised to enable the seed to be easily covered. We now draw attention, in a rapid *résumé*, to what Mr Roberts has said in his essay having reference to other points connected with the management of the wheat crop. And, first, as to the

Application of dung or artificial manures.—Farmyard, possessing as it does all the manurial constituents required for our farm crops, would be all that is necessary for the wheat crop, if it could only be obtained in sufficient quantity. But this cannot always be had, and this, as well as other circumstances, come into play, necessitating the use of, or at all events suggesting the expediency of using, one of the many varieties of artificial manures at the disposal of the farmer. But first as to dung. As has been already stated, when this is applied to the land in liberal quantities for the wheat, it should not be applied directly to the crop, but rather to the preceding crop of pulse, clover, or root crop; for if this is done, all those active ingredients are taken up by those preceding crops, which, if given to the wheat crop directly, would only force an abundance of straw, to the detriment of the grain; while the ingredients left by these crops leave the land in a proper heart for the wheat. If a naked fallow precedes the wheat crop, the dung should be applied to the land as early in the summer as possible. The practice, therefore, of manuring in the autumn directly for the wheat is objectionable. In the midland counties, the plan is often adopted of giving four or five loads of dung to the acre and half, and folding with sheep as a good manuring for the wheat crop. A large proportion of land is manured for wheat, especially upon dry soils, by the folding of sheep alone; it consolidates the soil, and kills, or at least lessens, the ravages of insects. To fold sheep upon fallow is also often of advantage; while the same may be said of it when

practised upon light soils *after sowing the seed*. Green crops are sometimes ploughed-in directly, instead of eating them off with sheep; opinion is divided as to which is the best. Where the soil is light, the benefits of consolidation obtained by the folding of sheep are of course lost in the former mode. Where cow-dung or pigeon-dung can be obtained in sufficient quantity, a top-dressing of 30 to 40 bushels per acre will be beneficial to the wheat crop on almost every kind of soil; the manure should be covered in with a light harrow, or it may be drilled between the rows of plants. Soot is generally very beneficial as a top-dressing to the wheat crop; 30 to 40 bushels per acre is the quantity applied, and this should be given not later than March. As soon as applied it should be covered in, and applied also in damp or moist weather. Soot, it is right to state, is not so markedly beneficial in some as it is in other soils. Rape-cake is a very valuable manure for wheat, applied at the time of sowing; it acts also as a preventive of the ravages of the wire-worm—at least it has done so on some soils; it may also be drilled in between the rows in spring; from 8 to 10 bushels may be applied; its beneficial effects are best displayed in heavy soils with a dry subsoil. Malt-dust has, to the extent of 30 to 50 bushels per acre, been also used with advantage to the wheat crop. Bones, on dry soils, at the rate of 16 to 30 bushels per acre, may be applied with much advantage. Guano, at the rate of 2 to 3 cwt. per acre, may be advantageously applied at the time of sowing. Nitrates of soda and potash, and common salt, are all applied, and with advantage, to the crop. When taking up our notes specially bearing upon the manuring of the wheat crop and the varieties of seed, we shall return to what Mr Roberts says on these heads, proceeding, meanwhile, to glance at his remarks on the other points connected with the general management of the crop; and, first, as to the

Treatment of the crops in spring as to pressing and hoeing.—Pressing in the dry weather in spring is especially useful on loose and open soils, and on soils which require draining; for when water saturates the surface soil, it becomes increased in bulk during winter by its conversion into ice, raising the soil, and tending, when a thaw comes, to throw out the plants. When soil treads loose in spring, it is important to use the heavy roller. Croskill's clod-crusher is also highly useful, but it can only be used in very dry weather. Folding with sheep is also useful. In the Fens, the loose soil along the drills is consolidated by men and women trampling along them.

Where the land is foul, when the seed is sown broadcast, the hand-hoe must be unsparingly used to keep down the weeds; where drilling and dibbling has been the mode of sowing practised, the horse-hoe can be used with advantage. Whether weedy or not, hoeing is practised by some, and dibbling with advantage, as it enables the plant to take a fresh start in the loosened soil. Hoeing should be begun as early as the weather in the spring

admits. Harrowing is often practised with success ; more especially where the land is crusty, and the roots have struck deep in the ground. Any mode, indeed, of loosening the surface soil in spring enables the plants to take a fresh start and to improve amazingly. Harrowing light-sand and gravelly soils obliquely, or at right angles to the drills, is peculiarly advantageous, tending as it does to destroy the poppy and other weeds which infest such soils ; to destroy the poppy, it has been recommended to harrow when the surface soil is slightly crusted with frost. If the plants are extremely luxuriant in spring, it is beneficial to "flag" them, as it is called—that is, to cut off, by a scythe or bagging hook, the blades or leaves from the stalk ; this should be done early, not later than May, as if done later the ears, or the part which would form the ears, might be cut off.

In an able paper by Professor Tanner, in the 'Journal of the Royal Agricultural Society,' on "The Mechanical Condition of the Soil favourable for the Growth of Seed," there are some practically valuable remarks in connection with the wheat crop, to which we now direct attention in the following condensed epitome. The heaviest clay soils are generally prepared by *bare fallow*. When this is properly managed, the soil becomes broken up by the winter's frost, baked by the spring and summer's sun, and crumbled by the descending rain and the gentle dews, and, in combination with its implemental stirring and inversion, it is finally changed from a close adhesive bricky character to one in its pulverised condition fitted for the wheat plants. In some very heavy soils the bare fallow is essentially necessary for the wheat-crop preparation. The degree of fineness for the wheat crop to which the soil is to be reduced in heavy clays is a matter on which there is considerable diversity of opinion ; but the general opinion seems to be that the land should not be rolled so as to bring it into a fine state unless the land is foul, and it is necessary to give the seeds of any weeds which may be in the soil a better opportunity to grow. Even in such cases, risk is run in wet weather of having the soil pasty ; so that it is better to keep the soil in a small lumpy state than in a dusty one. The last ploughing of heavy soils should leave the land in ridges, and the ploughed earth should not be broken down till sowing. It is advisable to prepare the soils early in the season, while the earth may be easily thrown together in a dry state, and then left till sowing. Professor Tanner agrees with Mr Roberts as to the advantages of having the stitches or furrows narrow, so that they may be covered at one bout with the harrow or the drill, and the horses may walk in the furrows. If the land has been prepared in good time and in good condition, and the weather favourable, Professor Tanner would prefer to sow the seed broadcast rather than run the risk of losing the proper time and condition of soil by choosing the slower operation of drilling. In all clay lands of a

strong character, it is of the utmost importance to avoid the poaching and treading of the land by the horses, and to have the seed in as early as the climate of the locality will permit of. For so attractive and retentive of moisture is clay of this character, that it not only absorbs it from the air, but, when rain falls, its pores are filled up, and, if pressed upon, a firm adhesion of its particles is the result. The feet-holes of horses retain, therefore, the moisture long after the land is generally dry; and the contraction of the soil when drying, and its expansion while being wetted, have a most deleterious influence upon the growth of the plant. When the seed is got in, it should be harrowed, but only sufficiently to cover the seed, not to make the surface smooth, and rolling should be certainly avoided. If a fine surface is obtained either by over-harrowing or by rolling, the first heavy rain which comes forms a muddy coating, which in dry weather becomes a dry crust. This crust prevents the play of the atmospheric influences upon the rootlets of the plants, and hinders their tillering. The surface should therefore be left in a rough state, consistent with the actual covering of the seed. These rough clods act as good shelter to the young plants during the hard frosts and the biting winds of winter and early spring, and will mellow down into a fine tilth as genial weather approaches; so that when spring rolling is carried out, a valuable help will be given to the young plants. But while the farmer is counselled to leave his land rough, it is not meant thereby that he has to leave it so rough as to be negligent or slovenly in appearance—a neatly-finished cornfield is an indication of general good management. So that, while the surface is left rough, labourers should be sent in to finish neatly off all the furrows and water-gutters, which latter should be given to all lands of this class, even although carefully under-drained. The above remarks have reference to the mechanical condition of heavy soils, where a “bare,” “naked,” or “summer fallow”—for by all these names it is known—is the practice.

We now come to what Professor Tanner says on the management of clay soils, where the wheat crop is preceded by a crop of autumn feed or early roots, as rape, cabbage, vetches, mangolds, or potatoes. The soils where these crops are taken may be designated *medium clays*, being of a somewhat lighter character than those heavy tenacious clays where the bare fallow is the best mode of preparation. Where beans has been the preceding crop, the land, having been hoed, will not be very foul with weeds, and may therefore be looked upon as in pretty good condition. It may be the better for being skimmed, and having the weeds burnt. Where this cannot be done through the ground being too hard, the plough may be used, preceding its operation with the fork, so as to get out the couch grass. When summer tillage has been well carried out, a single ploughing is all that is necessary. Where the autumn feed, as rape, vetches, has been consumed by sheep on the land, and it has,

in consequence of rain falling, become very hard, two ploughings may be necessary ; and if so, ten to fourteen days should elapse between the two ploughings, so as to allow the soil to regain the firmness necessary for the seed. It is always, however, well where this second ploughing can be avoided, for it does away with, or tends to do away with, the solidity of seed-bed which wheat requires. It is seldom, however, that in stiff clays there is any difficulty in getting this solidity of seed-bed, although, after vetches, the land is apt to be puffy ; but this is corrected by folding sheep upon it to consume the crop as it stands.

Where the wheat has to be sown after an autumn crop of green food upon *light land*, it is requisite to be very careful as to the firmness of the soil. It is generally objectionable to sow wheat upon this plan in the southern districts, though it is often practised in the northern districts of England ; but these measures are specially taken to give firmness to the soil. The crops of autumn food, which in these districts usually precede the wheat, are rape, turnips and rape, and common turnips ; and these are always consumed on the land by sheep. After the land is ploughed, the presser is taken over it ; but if this does not give the necessary firmness, sheep may be turned in to tread it down, thus giving a consolidation which no rolling can ever give it. Should all this fail in consolidating the soil properly, the only way is to change the cropping, and take the wheat after clover, which, after all, in such soils, is the best preparation for the wheat crop. But as there is in the northern counties a strong objection to wheat after clover, the only mode at disposal is to sow the seed while the land is wet, which will secure the firmness required. A clover-ley, well inverted by the plough, offers a fine firm furrow ; hence its advantages for the wheat crop. The furrow is all the better for lying for some time after inversion, so that the seed may be sown upon a "stale furrow." It is also advisable to use a skim-coulter with the plough to assist in burying the turf completely, otherwise the clover is apt to spring up between the furrows, which is objectionable.

As the *land becomes lighter* on which it is proposed to raise a wheat crop, the land-presser comes in to aid most opportunely and efficiently in getting a consolidated seed-bed. Professor Tanner states that he has frequently with advantage used a *small drill* in conjunction with the presser for sowing clover-ley, especially in wet seasons, when the soil is disposed to be rather adhesive. Such land, he says, can often be ploughed up quite dry enough for immediate sowing ; but before a sufficient breadth of it can be prepared for a day's work of a *large drill*, it gets too wet to be worked, and often has to lie therefore a considerable time before drilling. But by the use of one of these press-drills, the ground can be pressed, drilled, and harrowed close after the plough.

Professor Tanner draws special attention to the important condition

in wheat culture of the degree of moisture in the land. The seed he conceives should be sown on clay soils as dry as possible, for moisture will be sure to follow rain. Where the land is, on the contrary, wet when sowing is performed, the particles of soil cohere together. There is less objection to the working of light soils in a wet condition. It is not often, the Professor remarks, that sowing is carried on in the south of England in wet weather; but yet he has seen it done, and while the land was quite muddy. Nevertheless, the crop was the best on the wetted land; but, he judiciously remarks, this, which may be safe upon one soil, will often be very injurious upon another *apparently* of the same character. The proportion of sand or grit which soils contain is that indeed which separates those soils which can be worked without injury while moist from those which cannot be so done. In sandy or gritty soils the germination of the seed is little delayed, even although sown when wet.

Climate, the Professor points out, is that which almost alone decides the time when seed should be sown; "for neither the character of the soil, proximity to the sea, elevation, nor any other individual influence decides the practice, but that peculiar knowledge which renders local experience alone worthy of confidence." October and November are the usual months for sowing in the principal wheat districts; but from the middle of September to the end of the year must include all the sowings of the autumn-wheat. The more exposed the situation, the earlier the time and the greater the quantity of seed to be observed and required. In the mild districts of the west of England the sowing may be made at the end of December, without any damage to the crop; but in northern districts, seed sown so late would nearly all miss, and that which would germinate would produce wretched plants. The rule which regulates the *quantity* of the seed, Professor Tanner says, is this: "The earlier sowings require less seed, whilst, for the later sowings, the quantity should be gradually increased; and, again, as the soil and climate become more favourable to the growth of wheat, less seed becomes necessary. The first sowings will take 5 to 6 pecks per acre; whilst the latest will range up to 8 pecks, and a poor land up to as many as 10 pecks. The influence of soil upon the quantity of seed to be sown is very marked; the richer the soil the less the seed required. This is accounted for by the supposition that, in rich lands, the plant tillers better than in poor soils, throwing up a greater number of poor stems. In poor land, therefore, more seed is necessary to increase the stems and to enable the crop more thoroughly to search for food in the soil.

The depth to which the seed should be sown depends upon the closeness of the soil, and therefore changes with different textures of soil. On loamy soils, a depth of *one* inch is found to be the best—but in proportion as the soil becomes lighter should the depth be increased till it reaches $1\frac{1}{2}$ and 2 inches. The mode of ploughing-

in seed wheat with a three or four-inch furrow, the Professor says, is clearly wrong—for at such a depth the plant will not establish its roots in the soil, and its growth upwards will be much delayed. If any difference in the depth is to be made in loamy soils, it should be made thus—the early seed should be sown the deepest, as then there is plenty of time for the growth of the plants, and a deep growth insures a firmer root; but no variation in depth should exceed half an inch. The lighter the soil the greater the depth, for the firmer the root obtained.

In sowing spring wheat, the soil need not be so firm as for autumn wheat, but the difference is only one of degree. For when wheat is sown upon land not sufficiently firm, the plant fails in the severe weather of winter; the more solid the bed therefore, the firmer the hold of the roots in the soil, so that frosts cannot dislodge the plants. The great necessity then for a firm seed-bed in autumn, arises from the desire to insure stability of position of the plant during winter. This necessity does not exist so markedly in spring. The preparation of the land in this season for the wheat crop, is therefore much less troublesome and costly than that of autumn. When the roots of the preceding green crop have been removed from or consumed upon the land, it is ploughed once, and the seed is sown as soon as a favourable opportunity presents itself, so as to have the soil in good dry working order. A second ploughing—for the reasons already stated—is seldom given. Spring wheat should be sown early; none, excepting the April wheat, should be sown later than February in the eastern, and March in the western districts of England.

We have thus given a rapid *resumé* of Professor Tanner's paper, so far as it relates to the wheat crop. We now, in concluding this paper, do the same office for a prize paper by Mr J. D. Pratt, in the Journal of the Bath and West of England Society, with a view to draw more special attention to the writer's system of managing very heavy clay lands, usually placed under the summer fallow system. The ordinary system pursued by occupiers of poor clay lands, in which the working of the summer fallow is generally deferred till May, when the first ploughing is then given, admits, as Mr Pratt points out, of no improvement of the land for wheat, or indeed for any other crop; for naturally the same results will follow year after year; while, if possible, its stubborn and adhesive texture is increased during the two years' rest (during which the land is generally under grass), as it is called (and truly so, for it produces nothing), by the winter rain constantly hammering on and hardening its surface, shutting up every aperture from the beneficial effects of frost and sunshine, thus defeating the very work of amelioration which Nature has provided. Mr Pratt then details his mode of working a system of fallowing *from autumn through winter* on all the heavy lands in his occupation, and of which we now offer an epitome.

On the best description of land, Mr Pratt grows mangold-wurzel

and the artificial grasses alternately with wheat. The foundation of this course of cropping is laid by ploughing and subsoiling to a depth of fourteen inches the "ley wheat erishes," doing this as soon after harvest as possible, and has sometimes been done as early as August. The rough surface and clods are exposed to the sunshine of September, sometimes, as above stated, of August, which opens up fissures into which the rain of winter descends, passing through and between the clods, and, when frost comes, helps the work of disintegration wonderfully. The influence upon the clods in this way is very different from that obtained by the usual fallow with its hard surface, upon which the rain beats and the frosts act only superficially. In February, or earlier, dry weather should be chosen to "change sides with the fallow, and expose the under portion to a similar process." This helps to evaporate cold winter water, and to raise the temperature of the soil. Mr Pratt draws attention here to another, and "apparently incomprehensible, but nevertheless perfectly sound, advantage" obtained by the drying of the soil; for the drier the clods are made in winter and in early spring, the better they retain the moisture in the dry summer months. March winds and the subsequent frosts operate again upon these reproduced clods—produced by changing sides with the fallow, as before stated—and bring them into a fine tilth in remarkable contrast to the hard, tough, shining furrows of "rich earth exhibited when the ploughing and fallowing have been deferred, as is usually, or often the case, till spring." The labour of preparation for the mangold-seed, is trifling, comparatively, and the horse-hoe finishes the work of the summer fallow. Since Mr Pratt has adopted this system, he has effected a large saving, in the spring, of horse-labour, and the work of clod-crushers and rollers is in a great measure superseded by the work of natural influences.* The few remaining clods left here and there over the field, are beneficial rather than otherwise; inasmuch as they hinder that cementing action which wind and sun (after rain) have upon fine mould; while they act also as shelter-clods for the young plants, and retain moisture near them while they finally get themselves reduced to fine mould for the roots to penetrate in. The same system applies to every description of heavy land, from the richest to the poorest; rape, however, being taken in the case of the poorest soil, in place of mangold-wurzel.

Rape, Mr Pratt states, surpasses all other fallow crops for heavy land; for, in addition to its possessing deeply-penetrating

* See Mr Stephens's work, 'Yester Deep Land-Culture,' for a most suggestive chapter on the influence of the atmosphere in reducing clods to a fine tilth, and also for a very remarkable prophecy or suggestion, that by the extension of deep culture, clod-crushers, and the like, would be superseded. We have ourselves for a long time advocated the opinion that the imposing array of implements and machines are many of them the mere necessities of a bad system of culture. By bringing in a more philosophical system—as deep culture—we shall reduce, we think, our implements to a minimum, *very much below* the present standard.

roots, which open up and drain the soil, it comes to such an early maturity that ample time is allowed to have the land prepared for the succeeding wheat crop. None need, he says, be deterred from growing rape from fear as to the poverty of the soil. Mr Pratt has proved by successful practice on a cold and undrainable clay at a high elevation, and which had been abandoned as worthless, "that when a crop has once been grown, it is much easier to grow a second crop after; for the soil is by these means raised a stage in fertility, the climate is improved, and the temperature of the soil raised by the circulation of the air through it by means of the fibres of the rape plants; and if further evidence be required, 35 bushels per acre were produced where 20 had never been attained before."

The preparation for wheat after seeds, alike with that after roots, extends in Mr Pratt's system over the whole previous year. Indeed the whole system of cultivating both corn and roots is so entirely bound up, and each part of it is so dependent upon the other, that Mr Pratt does not know how to separate the two. In September, or as soon after harvest as showery weather offers, the clover erishes or ley should be well manured on the surface with farmyard compost, or from 3 to 4 cwt. of guano. Care must be taken not to allow the sheep to nibble the plants too closely, whilst they should not be allowed to pasture later than October. When the clover crop has to be grazed off the same land, it is especially desirable in the case of the grass seeds to defer the grazing till the plants are 8 to 10 inches high. The greater the surface vegetation of the seeds, the more nourishment they draw from the atmosphere. Indeed every effort should be made to increase, by every possible means, the amount of clover vegetation above the surface and the corresponding roots below, so that an increase of food for the coming wheat crop may be secured.

The ploughing of the rape and turnip, or mangold-wurzel erishes, must be of a shallower description than that in the clover ley. The ploughing should for wheat, in all cases, be in the direction of the field's slope, for each furrow, if well turned, acts as a drain. And where the soil is very wet and tenacious, with a flat situation, it will be advisable to plough it up in beds of 13 feet wide; these being practically formed by a rounded slope from the centre or "lye" to the bottom furrow. After ploughing, the rape erishes will be sufficiently prepared for the seed by a double stroke of the harrows in the direction of the furrows, the drill afterwards proceeding across them. The leys will probably require more harrowing, but in all cases the amount of harrowing will increase or diminish with the dryness or wetness of the season. These operations being all completed, the furrows are all cleared, and free vent made for the water. Other furrows must also be made through every hollow. Mr Pratt gives some notes as to the varieties of seed wheat, the time and mode of sowing, &c. &c.; but on these points we have already discussed.

B.

THE HERRING.*

WHEN, several years ago, we began to direct attention to the natural history of the salmon, and to the importance of the art of pisciculture as a means of multiplying this valuable fish, we did not foresee the extent and the interest of the study in which we had engaged. Month by month, year by year, our materials in connection with the natural history of fishes have accumulated, until our contributions to this Journal have comprehended reviews of all the most important British and foreign works on the rearing of fish in the sea as well as in lakes and rivers.

Incidentally we have also treated of the value of fish as an alimentary substance widely diffused, and of the highest importance in helping to solve the growingly-urgent social problem, How is the rapidly-augmenting population of this country to be adequately fed?

In another series of papers, also published in this Journal, we have had to refer to scenes of misery when discussing the physical condition of the people—misery not the less to be deplored because occurring in the vicinity of the literally boundless stores of food treasured in the waters which surround the British Isles. “Voluntary poverty” may be a merit in the eyes of narrow-minded religionists, who have not sense enough to know that God has given us all things richly to enjoy: for a nation to be poor, by neglecting to avail itself of the bounties of providence, is political suicide, accomplished by a lingering agony, to witness which is pitiful. The wretchedness of Ireland was a scandal to Europe until the recent dawn of brighter days for that unhappy land; and, however proud of our country, we Scotch must sigh and blush when we think of the miserable penury which is chronic in certain Highland and maritime districts, and which elsewhere recurs periodically with a severity necessitating spasmodic efforts of charity, frowned upon by political economists, and not approved of by the reason of the benevolent, who follow the impulse of feeling even while their judgment is not blind to the comparative uselessness of a remedy known to be but temporary.

Until remunerative industry is provided for those able to work charity is a makeshift which aggravates the evil it can only palliate for a season. The astonishing fact in connection with the penury of certain portions of the British people is this—employment, unfailing and sufficient to supply all they need, is at their doors, but they will not resort to it. The Celtic race seem affected

* ‘The Herring: Its Natural History and National Importance.’ By John M. Mitchell, F.R.S.S.A., F.S.A.S., F.R.P.S., &c. With Illustrations. Edinburgh: Edmonston & Douglas. 1864.

with somewhat of the horror of the sea which characterises the modern Hindoo, and with that aversion to fish and fishing exhibited during the uncivilised period of ancient Greece.

A writer in the 'Quarterly Review,' in a notice of Mr Yarrell's 'British Fishes,' says of the starving Irish, "These people have their salvation before their eyes, but they will not turn to it with a good heart." "It is the same," continues this writer, "or even worse, with the Hebrides at this moment. We happen to number among the most esteemed of our personal friends one of the principal proprietors of that interesting archipelago; and we are assured that though, during thirty years past, that family has made every effort to encourage sea-fishing among their dependants, it has never been in their power to procure, except during the smoothest weather of summer and autumn, a decent supply of sea-fish even for their own table."

This is corroborated by the recent statements of Mr Andrews, President of the Natural History Society of Dublin, who, when speaking of the depression of the Irish fisheries, says that the salt fish imported into Ireland annually amounts to 1200 tons, valued at £27,000; and that the annual import of herrings is about 80,000 barrels, valued at £128,000; and this, too, at a time when the Irish fisheries, if properly worked, are far more than equal to any demand which can be made upon them. Irishmen living on imported fish! this is really too absurd. The provoking part of this Irish folly is yet to be told. Enterprising foreign craft come to the coast of Ireland and carry off the treasures of the deep before the very eyes of the often starving natives of the country. Hearing such things makes one ask, Of what use, then, is the sea?

Such statements may surprise some of our readers, especially those living in large towns, fish-fed by the cheap and rapid means of transit furnished by the railway; and those not familiar with the household economy of "huts where poor men lie" may fancy that ichthyophagy must be far from rare. And it must be owned that certain things seem to indicate that such is the fact. For instance, in the very interesting evidence given before the Royal Commission for visiting the Universities of Scotland by the late Principal Lee, we find the reverend gentleman declaring that, when a student at Edinburgh College, he knew young men living for a session chiefly on herring and oatmeal. And another reverend doctor, an intimate friend of the Principal, has often laughingly declined to taste herring at our table, because he ate so many when a student that he was satisfied for life! Moreover, our Scottish literature has about it an undeniable smack of the herring. Our daily talk, our moralising proverbs, our love-songs, have all a savour of this fish. "Dead as a herring" is said of one who is "gone" beyond remeid, and is probably an allusion to the fact that the herring dies the moment that it is taken out of the water, in consequence of the gill-covers

being very loose and opening wide. And when we wish to indicate a man's individual responsibility, we tell him significantly "ilka herrin' man hing by its ain head." When the Scottish swain seeks to ingratiate himself with his sweetheart, he brings before her a picture of "the gear," to the worth of which he flatters himself she will not be blind. Distrustful of the value to be attached to "a hen wi' a happety leg," he adds the item of "a herrin' in saut," and then ventures to ask—

"Tell me, lass, an ye lo'e me noo?"

Were any one to quote sundry passages from Burns to silence the hypocrite who should pretend that the Scotch don't like whisky, he would certainly *nonplus* his antagonist. How, then, after being so frank in our admission of the fishy odour pervading Scottish life and conversation, can we maintain that the Scotch neither catch nor eat enough of herring?

As to the poor students at Edinburgh University living on herrings and oatmeal, that is not to be wondered at, considering the proximity of Newhaven to the Scottish metropolis. But since the days of Principal Lee we suspect there is no small change in the style of student diet. At all events, when attending that renowned university, we certify that our fellow-students, though daily hearing the (now, alas! discontinued) merry chimes of St Giles's playing "Caller Herrin'," responded to the call,

"Wha'll buy my herrin', fresh frae the sea?"

in a fashion not likely to find favour with a fishwife. They were addicted to having a *red* herring to supper, having made the curious physiological discovery, that the fish so prepared, if eaten and washed down by a pot of porter, left on the palate so strong a flavour of raw oysters as to necessitate its removal by the speedy imbibition of a tumbler of toddy. As to the inference regarding the fish-eating habits of the people which a stranger might draw from the ichthyological similitudes to be found in Scottish songs and proverbs, we must correct it by means of our better knowledge. We are not even now a fish-eating race to anything like the extent which might be anticipated from our maritime position. We do not eat salmon because they are too dear, and must so continue until pisciculture be resorted to on the large scale which we have so often recommended; cod and haddocks are not habitually eaten even by the middle classes; skate, generally undervalued, is scorned by the multitude; and as to eels the antipathy to them is notorious.

As to the herring, the extent to which it is captured is very great. Still, we are not sufficiently alive to the national importance of this branch of marine industry. The ignorance of most of us in regard to the natural history of this most interesting fish is astonishing; for which, indeed, we are not altogether to be blamed. Our

"practical men," and our reputedly learned men, besides, have been too long blind leaders of the blind. Assertions have been made, and assented to, in regard to the habits and the *habitat* of the herring which ought to have been discontinued and disbelieved long ere now. But as ignorance in regard to this important fish, and partial comprehension of its influence on our national fortunes, are still prevalent, we are glad that the publication of Mr Mitchell's very useful work affords us the opportunity of treating of various matters connected with this branch of British fisheries.

This gentleman, occupying the position of Belgian Consul at Leith, and living on the banks of the Forth, has excellent opportunities of examining into the natural history of the herring and its congeners; and the information he communicates is the more trustworthy, from his having been at the pains to prosecute his researches by visiting not only the chief sites of the British herring-fisheries, but also the shores of the Baltic and of the German Ocean, besides residing in Norway and inspecting the principal fishing districts of that country. He has also visited the principal fishing ports of France from Dieppe to Marseilles.

We willingly acknowledge the value of the information thus acquired, while demurring to the rather too self-complacent tone of the following sentence in his preface:—"The author believes he has satisfactorily solved the hitherto disputed questions as to food, periodical visits, migration, &c.; he has also, for the first time, established the important fact that herrings visit our coasts twice in the year; that, in fact, there is a winter and a summer herring periodically arriving on the different coasts, and already, from this knowledge, additional supplies have been obtained where no previous fishery existed." After perusing this, we are not surprised to find Mr Mitchell disputing the authority of sundry statements made by such well-informed writers as Cuvier, and his editor, Professor Valenciennes, and Messrs Yarrell and M'Culloch. We do not think him right in demanding proof of this statement in the 'Dictionary of Commerce' by the last-named author. "There is perhaps no branch of industry, the importance of which has been so much overrated as that of the herring-fishing. For more than two centuries, company after company has been formed for its prosecution; fishing villages have been built, piers constructed, boards and regulations established, and vast sums expended in bounties, yet the fishery remains in a very feeble and unhealthy state." As to the concluding assertion, Mr M'Culloch, in his notes on Adam Smith's 'Wealth of Nations,' has evidently seen cause to modify it, for there he thus writes:—"The character of British herrings now stands deservedly high, and the fishery is become a source of profit and employment to a considerable number of people." We cannot, therefore, allow that Mr M'Culloch unreasonably depreciates the herring-fishing, which, in the opinion of Mr Mitchell, exceeds in

worth "the auriferous deposits of gold-diggings." When a man has a hobby for anything, as the Belgian Consul at Leith has for herring, we like him none the worse for riding it boldly and taking the field against all comers. But when he demands proof of the assertion that the herring-fishing has been overrated, it appears to us that his zeal has blinded him to what he himself declares—"in truth, the herring-fishing has become prosperous in spite of every obstacle thrown in its way by the erroneous Government exactions and prohibitions." That this is true we have superabundant demonstration in his tediously lengthy "chronological history of the herring-fishery." And as Mr M'Culloch makes specific mention of "bounties," and cannot be supposed ignorant of the Government follies acknowledged by Mr Mitchell, we, bearing this in mind, hold him justified in maintaining that the herring-fishing has been overrated. The fact is that, partly from envy of the Dutch, partly from erroneous notions as to the power of Government to supersede individual enterprise, and nurse a neglected industry into sudden vigour, the most absurd expedients have been resorted to in order to stimulate the herring-fishery; and foolish expectations of turning the ocean into an El Dorado have repeatedly turned out as futile as the great South Sea bubble.

The encouragement of the fishery by means of a bounty has been the chief obstacle to its prosecution; and this folly was persisted in long after Adam Smith had shown that Parliament had been grossly imposed on in regard to the benefits said to result from the system. During the herring mania of last century political philosophy was disregarded, while demonstrating that though the Dutch, at a distance from the chief resorts of the herring, were right to employ "busses" (covered vessels of from twenty to eighty tons)—boats, capable of following the migrations of the fish into our estuaries, bays, and arms of the sea, were the most suitable for the British fishermen. Never was there a more obvious *non-sequitur* than was involved in the popular argument. "Holland is enriched by herring; Amsterdam is admitted by the Dutch to be founded on herring bones; the Dutch employ busses, therefore, if we do so likewise, we shall more than rival their prosperity. Let Parliament, then, grant a liberal bounty upon busses." To this disjointed reasoning Parliament unfortunately gave ear. Busses swarmed along the British coasts; Scotland alone, in the year 1776, sent forth no less than 294 of them. But there was no increase in the number of the captured herring, because, as Adam Smith sagaciously observed, "the bounty is proportioned to the burden of the ship, not to her diligence or success in the fishery; and it has been too common, I fear, for vessels to fit out for the sole purpose of catching, not the fish, but the bounty. In the year 1759, when the bounty was at £2, 10s. the ton, the whole buss-fishery of Scotland brought in only four barrels of sea-sticks" (herrings caught and cured at sea).

When we add that every barrel of buss-caught herrings cured with Scotch salt, when exported, cost the Government 17s. 11½d.; and that every barrel cured with foreign salt, when exported, cost Government L.1, 7s. 5½d.; we think our readers must allow that this was a clear case of gold being bought too dear, and that it is no marvel that a political economist like Mr M'Culloch should denounce the over-appreciation of herring so caught. The collateral advantage of rearing a race of hardy seamen to man the royal fleet at the demand of his Majesty, could never justify such lavish expenditure, which, moreover, it was foretold, must infallibly extinguish the industry it was intended to foster. The bounty system has ceased, herrings are caught by the million, and her Majesty's fleet is at this day manned by as fine a set of sailors as ever ate sea-biscuit.

We differ, therefore, from Mr Mitchell when observing—"as to the expenditure of the public money on bounties and premiums, it may be seen that the public money hitherto expended has been of a comparatively small amount. It was to enable our own busses to compete with the foreign busses on equal terms." With the herring at their door our fishermen had a great advantage over the Dutch, who had to fit out large vessels to enable them to fish on our distant coasts; and the attempt to stimulate home industry by means of bounties was far from remunerative, when we find it proved that one year, with a bounty of £2, 10s. per ton, the buss fishery of Scotland yielded "only four barrels of sea-sticks."

Mr Mitchell is surprised to find the author of the article "Ichthyology," in the last edition of the 'Encyclopædia Britannica,' adopting Pennant's erroneous theory as to "herrings coming from the icy ocean" to this extent, that he quotes it, and says: "In truth, we are not furnished with sufficient data to decide the question; but, in the mean time, we do not feel inclined entirely to reject the generally received opinion, that the herrings migrate from north to south in summer and autumn;" and he then proceeds to describe the "vast troops" which Pennant so fabulously mentions. He says, "The shoals are generally preceded, sometimes for days, by one or two males;" a very difficult fact to ascertain." Very true; but from the ambiguous way in which Mr Mitchell expresses himself we are in doubt whether this fact rests on the authority of the writer in the *Encyclopædia* or on that of Pennant. It is very silly to make such an assertion, as no human being can be sure that two big herring are "acting as guides" of the shoals which they seem to precede; but having Pennant's statement lying before us, we find in it no reason for fathering this folly upon him. It seems to have been added to it by some lover of the marvellous. Moreover, we find reason for questioning the truth of the general belief that this estimable author was the first to propagate what is now deemed a mistake as to the

source whence annually come forth those herring-shoals which make the waves of the ocean resplendent with their glittering hues, and supply a never-failing harvest for the sustenance of man, as well as of numerous orders of birds and fishes. Turning to 'Collection Complète des Œuvres de Charles Bonnet,' the eminent Genevese philosopher and naturalist, we discover the apparent source of the now reputed apocryphal migration of the herring from the regions of "thick-ribbed ice."

Pennant, an accomplished and benevolent Englishman, did good service to Scotland by making its resources known to his countrymen south of the Tweed, and by helping to cultivate a good understanding betwixt the people of North and South Britain. He paid particular attention to what was needed for the development of the Scottish fisheries. His journey to Scotland and his voyage to the Hebrides, begun in 1772, were completed in 1775. Attention to this date enables us to do justice to a worthy man, and to prove that, as he has not been the last, assuredly he was not the first to give currency to the assertion regarding the arctic-pole-haunting habit of the herring. Here is his statement: after representing them as coming from their great winter rendezvous within the arctic circle, he proceeds thus:—

"They begin to appear off the Shetland Isles in April and May. These are only forerunners of the grand shoal which comes in June; and their appearance is marked by certain signs, by the numbers of birds, such as gannets and others, which follow to prey on them. But when the main body approaches, its breadth and depth are such as to alter the very appearance of the ocean. It is divided into distinct columns of five or six miles in length and three or four in breadth, and they drive the water before them with a kind of rippling; sometimes they sink for the space of ten or fifteen minutes, then rise again to the surface, and in bright weather reflect a variety of splendid colours. The first check this army meets in its march southward is from the Shetland Isles which divide it into two parts. One wing takes to the east, the other to the western shores of Great Britain, and fill every bay and creek with their numbers. Others pass on to Yarmouth, the great and ancient mart of herrings; they then pass through the British Channel, and after that in a manner disappear. Those which take to the west, after offering themselves to the Hebrides, where the great stationary fishing is, proceed towards the north of Ireland, where they meet with a second interruption, and are obliged to make a second division. The one takes to the western side, and is scarce perceived, being soon lost in the immensity of the Atlantic; but the other, which passes into the Irish Sea, rejoices and feeds the inhabitants of most of the coasts that border on it."

This is so minute as to convey the idea that, to be accurate, the writer of it must have been amphibious, and that he spent his days either subaqueously or herring-hunting by means of the water-telescope—a valuable instrument used along the coasts of Norway, and deserving the attention of British fishermen. The fact, however, is, that Pennant derives his notions of the pole-haunting herring from Bonnet, whose 'Contemplation de la Nature' first appeared in 1764, and was speedily translated into most of the

languages of Europe. As Pennant in 1765 visited France, *Switzerland*, Holland, and part of Germany, and was intimate with Buffon, Haller, and the Gesners, we think it more than probable that at Geneva he made the acquaintance of the ingenious inquirer Bonnet, or at least was familiar with his writings. In the work of Bonnet we trace the origin of the for-long-generally-received belief regarding the migration of the herring. Our translation of a portion of it makes this apparent.

"Herrings migrate in great shoals from the north pole to the coasts of England and Holland. These migrations appear to be caused by the whales and other large fish of the arctic seas which pursue the herrings. These sea-monsters swallow at once whole tons of them. They often pursue their prey as far as the coasts of England and Holland. The herrings seem to be a mauna prepared by Providence for nourishing a great number of fish and sea-birds. In order that the species may be preserved, they must have the power of withdrawing from the pursuit of their enemies.

The herrings arrive on the coasts of England and Scotland about the beginning of June. These numerous legions then separate in several divisions. Some direct their course to the east, and others to the west. After having moved about for a while, the different shoals separate again and diffuse themselves among the shores of the seas of Britain and Germany, reunite afterwards, and finally disappear at the end of several months. It is not merely to withdraw from the pursuit of the large fishes which haunt the seas of the north that the herrings advance in such shoals towards the seas of England and Germany, it is also for the purpose of gathering there the abundant food which nature has prepared for them on these shores, which swarm with worms and small fish on which the herrings greedily feed, and on which they grow very fat. They at the same time spawn there, and it may be that they forsake the seas of the north because they no longer find in them food sufficient for their subsistence. We may assuredly conjecture, that in this respect herring and other migratory fish resemble birds of passage. The same instinct and the same necessities may determine the migrations of both; and these migrations are the means employed by the wisdom of nature for the preservation of these species so individually numerous."

Now that we have traced the long prevalent notion of the herrings' annual procession from the north pole, and succeeded, we think, in fathering it not on Pennant but on Bonnet, let us examine wherein the Genevese naturalist differs from the conclusions of more recent inquirers.

Few will question his hypothesis that the migrations of the herring are regulated by the same causes which occasion the migrations of birds—viz., the desire of procuring food for themselves, and convenient resting-places for the propagation of their species. But as to the tons of herring swallowed at a single gulp of a whale, there are serious difficulties in the way of our gulping that. In the first place, the true whale (*Balæna mysticetus*) of the polar sea is known to feed on the swarms of various species of *mollusca*, especially *medusæ*, which alone are suitable for its singularly limited powers of deglutition, which, it is asserted by arctic voyagers, could not embrace any object larger than an egg. However great the havoc which other species of whales commit on the herring-shoals, if

clupea harengus, the herring of our coast, wish to lead a peaceful life, he should remain in the circumpolar waters, and have no dread of the great Greenland whale. As this huge creature does not molest the herring, the southward migration of the latter cannot be owing to his dread of being swallowed wholesale—by tons at a time—as Bonnet fancies. If bent on such a gratification there is reason for doubting where he could find them. Herrings are nearly unknown within the polar seas, and have scarcely been observed by the arctic voyagers, and they are not taken by the Greenlanders. A small variety of the herring is sometimes found, and is noticed by Sir John Franklin.

As already indicated in our extract from his preface, we are surprised to find Mr Mitchell writing as if he had made important discoveries. Having read his work with care, we acknowledge its value as a repository of facts; but we cannot admit his claims to be regarded as an original observer, whose researches solve the hitherto disputed questions in the natural history of the herring. So far back as the year 1814, we find the writer of the article "Fishes," in the 'Edinburgh Encyclopædia,' thus combating Mr Pennant: "For what purpose they should have received an instinct to retire to the polar seas, is to us incomprehensible. The salmon, the shad, the smelt, are never found at sea, yet it is never said that they depart to any great distance from our shores. The most reasonable conjecture we can form is, that the herring, like our other migratory fishes, take to the deepest parts of the ocean." "In migrating from the deep seas to our shores, the herring seems to be prompted by a similar instinct to that of the shad and salmon, of casting its spawn in its native waters; however, they are more desultory in their movements than either of these fishes."

"From their first arrival in July they keep along both the east and west coasts of Scotland; and in October, after many erratic movements, they fix their residence where they mean to spawn. In these places they continue till the end of February (sometimes, but rarely, longer), and constitute what we call our winter fishing. In the Frith of Forth, for these several years past, this has been a very productive fishery; and during the present winter, 1814-15, the numbers of herring there taken and brought to Edinburgh markets have yielded a most abundant supply of nutritious food for the poorer class of the inhabitants of the city and its neighbourhood."

In like manner the late Dr Fleming, author of "Ichthyology" in the same Encyclopædia, writes: "It is now clearly established that the herrings, like all the other fishes that reside in deep water, approach the neighbouring shores when they are ready to spawn, and return to their favourite haunts when the process of reproduction is finished. The food of the herring consists of the smaller crustacea, and of young fishes, even of their own species." Similar statements are made by Sir Humphry Davy in 'Salmonia,' and by Mr Yarrell in

his 'History of British Fishes.' The latter author states that "three species of herring are said to visit the Baltic, and there are three seasons of roe and spawning. The stromling, or small spring herring, spawns when the ice begins to melt; then a large summer herring; and, lastly, towards the end of September, the autumn herring makes its appearance and deposits its spawn." The same distinguished naturalist has discovered what he thinks a second species of British herring: it is found heavy with roe at the end of January, and does not spawn till the middle of February.

So far from Mr Mitchell being the first to "solve the hitherto disputed questions as to food, periodical visits, migration," &c., of the herring, the preceding references prove that all that he says on these matters has been said habitually, for the last thirty years at least, by all naturalists of repute among us. And as to his being "the first to establish the important fact that herrings visit our coasts twice in the year—that, in fact, there is a winter and a summer herring periodically arriving on the different coasts"—we are certainly indebted to him for drawing attention to this habit of the fish; but we must be excused for declining to acknowledge that he was the first to observe it.

The capriciousness with which herrings change their haunts has given rise to many strange speculations as to the cause of a characteristic so annoying to those dependent on the regularity of its migrations. By not making prudent allowance for this peculiarity, and by constructing establishments as if for a fixed fishery, serious losses have been frequently incurred. From the Friths of Forth and Tay not only herring, but also haddock, took their departure about the year 1788, and did not reappear for nine or ten years.

In one of the earliest of Hugh Miller's productions descriptive of the Moray Frith herring-fishery, there is a notice of this peculiarity. From 1690 to 1709 there was an extensive fishery at Cromarty. Shortly after the Union (1707) an immense shoal ran themselves on shore in a little bay to the east of the town. The beach was covered with them to the depth of several feet, and casks failing the packers, the residue was carted away for manure by the neighbouring farmers. They disappeared in a single night, and were not seen again for more than fifty years! And so with very many other places frequented by the herrings. Of course they have good reasons for what we call their capriciousness. But if herring seem to be fickle, fishermen are not seldom stupid and lazy. They groan over the departure of the fish instead of carefully watching their movements. There is reason for believing that a little enterprise would often be rewarded by the discovery that the fish had moved to no great distance, and that their change of *habitat* might be traced by observing that luminosity of the sea caused by medusæ and other marine animals on which the herrings feed.

As already mentioned, the speculations in supposed explanation of the wayward movements of the herring are many. In illustration of the propensity of certain minds to join together, in the relation of cause and effect, things which are only accidentally connected, so that coincidences are mistaken for consequences, it may be mentioned that in the Hebrides the manufacture of kelp is popularly regarded as the reason why the herring deserted the Long Island; and that the lighting of fires, the ringing of bells, and the firing of cannon, are all associated with the vagaries of the herring. Will people never learn to be decently modest, and not afraid to say, "Such is the fact, but why it should be so we cannot tell"? When not ashamed to confess ignorance, we shall no longer read that herrings forsook the coast of Sweden on account of the din of the bombardment of Copenhagen; or that "Inverness, where sumtym was grit plenti of tak of herring, howbeit they be now evanist for offens that is maid against sum sanct;"* or that the people of St Monance, on the Fifeshire coast, were wont to tie up the parish church bell during the herring season. If the theory at Inverness as to the wrath of "sum sanct" be admissible as an explanation why herrings did not appear as expected, we must say the men at St Monance, by tying up the bell which summoned them to do him honour, exhibited a love of herring which must have been offensive to his holiness. The theory of steamboats having something to do with the herring deserting their haunts is falsified by the fact of herring preferring Loch Fyne since steamships have sailed to and from Inverary.

Instead of wasting time assigning fanciful reasons for what is known to be a fact in the natural history of the fish, it will be more to the purpose that we should consider whether, as in the case of salmon, the migratory instincts of the herring can be so guided as to make this fish inhabit waters which it has not heretofore frequented, or return to those which it has for a time deserted.

Its habits, there is reason for believing, are such as to encourage experiments in pisciculture such as have thrown so much light on the habits of the salmon. If rivers, heretofore destitute of this most valued of the fresh-water fishes, are no longer salmonless, we are encouraged to hope that the coast-haunting herring, if introduced in any favourable locality, may be found as regular in its periodic movements to and from the ocean-deeps as is the salmon in its migration from the sea to the river. We are glad to learn that "La Cepede says, that in North America the spawn of the herrings has been carried by the inhabitants and deposited at the mouth of a river which had never been frequented by that fish, and to which place the individual fishes from these spawn acquired a habit, and returned each year, bringing with them probably a great many

* Bellenden's 'Beece's Cosmographie of Albion,' xxiii.

other individuals of the same species." "It might," observes Mr Mitchell, "perhaps add to our knowledge of the natural history of this animal, if some of the proprietors of sea-water fish-ponds were to make experiments in the same way, or even by transporting the herring alive. The said author also states that in Sweden they have been transported alive to waters where they were wanted."

This is a statement equally interesting and important, and if La Cepede gives any details, it is to be regretted that they have not been fully given by Mr Mitchell, whose account of the mode in which the herring spawns, though apparently accurate enough, does not appear to throw upon it all the light that is desired, seeing that, so lately as 1862, the Commissioners of the Fishery Board employed men accustomed to use the diving apparatus to examine the localities where the herrings were supposed to deposit their spawn, and to bring up portions of it for examination. Various places in the Frith of Forth were examined without success, but at last, east of the Isle of May, a considerable quantity was found in twenty fathoms water, adhering to coarse shelly sand, the deposit being about three-fourths of an inch thick, and attached to a cake of the rough shells and sand. Though the divers saw in the vicinity of this spawn fishes like herring moving about, they did not see them so distinctly as to enable them positively to assert that they were herrings. The ova thus obtained produced little fish, exhibited at a meeting of the Royal Physical Society, and some of them lived in an aquarium about four weeks. Attempts also were made to breed them by placing the ova in boxes or cans in the sea, but unfortunately these were destroyed. There is thus only a strong probability that the vivified ova were those of the herring. The defects in this experiment are not thoroughly removed by Mr Mitchell's account of the manner in which the herring spawns. After describing the deposition of the ova on stones, rocks, and sea-weeds, to which they firmly adhere, he thus proceeds:—"The eyes are first observable—at least a small black speck is first seen in the egg. Then the head appears; and, in fourteen days, or *perhaps three weeks*, the young are seen in great abundance near the shore, of a very small size. In six or seven weeks more they are observed to be about three inches in length, and move about in large shoals in winter and spring on the various coasts, and in the rivers and bays generally resorted to by the herring-shoals; and *it is likely* that they attain to full size and maturity in *about* eighteen months."

When we find, in the most recent work on the herring, such indefinite phrases as those we have italicised; when the period at which the fish reaches maturity is only guessed at by reduplicated peradventures, we are not "perhaps," but positively of opinion that our knowledge of the natural history of herrings requires enlargement; and we know of no mode of attaining this desideratum so effectually as by so placing the procreant fish that they shall constantly

be watched by intelligent observers. How little did we know about the salmon! what nonsense was written about it, too, hurrying to and fro between the arctic seas and those of Great Britain, until its reproductive processes were studied in rearing-ponds and boxes! We are persuaded that similar experiments on the herring may be made with little difficulty; and this department of our fisheries being one in which Government already interferes, it is much to be desired that it should forthwith institute a piscicultural establishment, charged with the duty of specially investigating the natural history of the herring, alike in its natural *habitats* in the ocean, and in others selected for the convenience of scientific observation. It is all very well in my Lords of the Privy Council for Trade to send circulars to the fishing-stations, soliciting replies to queries anent herrings. We wish they may get them. The Dutch Government acts more intelligently, and with more patriotism, when authorising the Royal Meteorological Society of Holland to obtain information regarding the natural history of the herring; and so important is the information given in a work published by authority of that Government that the British Board of Trade has caused it to be translated into English. The British and the Dutch have had many a tough battle about fisheries; and now that we are such good friends as to interchange books about fish, instead of hard blows, we hope there may be a reciprocity in the interchange of information, and that we shall not be humbled by the Dutch continuing our superiors in ichthyological investigations, to engage in which we have such special inducements.

The fact is, though the strife be peaceful, the Dutch are at this moment contending with us, seeking to regain the prestige of their herrings, gradually diminished in consequence of the improved quality of the Scotch cured herrings. The number of busses employed by the Dutch has suffered very serious diminution, and the supply of fish has likewise been lessened in even a greater proportion. The herring-fishing of this country, on the contrary, and especially of Scotland, has made signal progress, and constitutes a branch of national industry deserving to be developed by all the appliances which can be brought to bear upon it by the combination of enterprise and capital guided by intelligence. Of the 91,139 people directly employed in the Scottish fisheries, 39,266 are fishermen; but, observes Mr Mitchell,—

“If we add those employed indirectly by the money derived from the fishery—namely, the boatbuilders, sailmakers, ropemakers, mastmakers, saltmakers, grocers, carters, porters, shipowners, sailors, and other trades—the number will appear incredible to those who have not an opportunity of closely observing the incalculable benefits accruing to the nation from the prosperous state of such a fishery. Here we see employment to the industrious classes, while they are adding an abundant supply of cheap and wholesome food for the numerous population of the British Islands, when other animal food is becoming so scarce and expensive.

"The great increase of this fishery has tended in no small degree to increase the wealth and the number of the population of the Scottish coasts; and the annual addition of the value of the herrings must have a great and beneficial influence on the prosperity, not only of Scotland, but of the British Islands. The addition of nearly one million sterling every year to our national wealth must be extremely gratifying to every patriotic mind."

In the reign of Henry VIII. one of the statutes thus recognises the importance of the fishermen of Kent and Sussex: "The which said mariners were put in daily experience and knowledge of the coasts of the sea, as well within this realm as in other parts beyond the sea, by the which practice it was great strength to this realm, by bringing up and increasing of mariners, whensoever the King's grace had great need of them." On this ground, when abstinence from flesh ceased to be considered a religious duty, it was attempted to keep up the consumption of fish by statutes passed at various times. The Act for the abstinence from flesh (passed in 1548) imposes penalties on persons eating flesh on "fish-days," of which in the year there were no less than a hundred and fifty-three.

The real object of all this intermeddling with the diet of the people being "for the maintenance of the navy," it is unpleasant to find Parliament preaching up abstinence from butcher-meat as "a means to virtue, and to subdue men's bodies to their soul and spirit," (2 and 3 Edw. VI. c. 19). We admit that fish "was much behoveful and necessary to the common weal of this realm," (1 H. VIII. c. 1), and that it was a scandal that "the natural subjects of this realm are not able to furnish the tenth part of the same with salted fish of their own taking," (39 Eliz. c. 10); but while clearly of opinion that the Crown, as the feudal possessor of the shores of this kingdom, ought to develop the inexhaustible resources of this magnificent domain, we, of course, object to all needless interference with the fisheries and the modes in which fishermen prosecute their calling. Notwithstanding the recent agitation for putting down the system of branding the prepared herrings, and thus giving a guarantee to purchasers that they are of a certain quality, impartial judges are of opinion that the system ought to be continued. We are disposed to go further, and to maintain that it is an important function of the Fishery Board to establish a coast guard so watchful that we shall not again hear of such senseless destruction of spawning-fish as occurred near Dunbar in September 1861. A shoal of herring having begun to spawn at a short distance from the harbour, were immediately assailed by the fishermen with such indecent greed, that on Sunday 1st September, and the two following days, the neighbourhood had the appearance of a fair, so great was the bustle in disposing of the most improperly captured herrings. This is monstrous. If a man were to open a shop in Dunbar for the purpose of shaving or selling "sweeties" on Sunday, we have no doubt that there would be an outcry. But

when lawless herring-slayers profane the Sabbath, they are, if not unblamed, at all events unmolested, which is all they care about ! Other folks besides the fishermen of Dunbar are apt to leave their sanctity on shore during the herring season. We once heard a Gaelic minister threaten to keep back from the communion-table all who should not abstain from fishing on the fast-day. When fishing is thus prosecuted "in season and out of season," we cannot be surprised to learn that many of the Highland sea-lochs, answering to the Norwegian fiords, no longer roll abundance to the very door of the now almost starving Highlander, whose unfair and unseasonable fishing has driven the persecuted herring from its haunts. In Norway, where 40,000 men are engaged in catching the herring, every facility which science and ingenuity can suggest is offered to its spawning in the numerous fiords ; and the spawn and fry are carefully protected from molestation, in order that the fish may keep upon their coasts, and breed in security. But our Scottish Fishery Board is loudly accused of being afraid to put in operation the law against trawling ; and there is reason for questioning the discretion of the Board in availing itself of the power to suspend any of the clauses in the recent Act. In January 1861 the clause prohibiting trawling with small-meshed nets was suspended, for the purpose of permitting the fishermen of the Forth to catch sprats, or garvies as they are called in Scotland ; and it is asserted that, on the morning after the removal of this wise restriction, four fishing-boats brought in and sold as garvies above 400,000 herring-fry. Had these fish been spared for a few months, and sold as herring at the rate of two a penny, they might have brought about £880, while as garvies they probably did not sell for more than as many farthings. We are aware that a report by Professor Huxley, Dr Lyon Playfair, and, we think, Mr Caird, urges that the slaughter of sea-fishes by all means invented by human ingenuity is so comparatively trifling, that it is ridiculous to interfere with trawling and garvie-catching. We read it with astonishment, and now protest against it as sanctioning a loose morality and reckless disregard of the future by no means to be encouraged. We are persuaded that it is possible to make fatal inroads upon the herring, type of inexhaustible fecundity though it be considered. Able ichthyologists maintain that the sprat or garvie is not the young of the herring—the distinction between them consisting in the position of the fins, and in the belly of the one being serrated, while the other is smooth. We are at a loss what authority to attach to the statement of an anonymous writer in the 'Cornhill Magazine,' who, from experiments he has made, insists that the latter peculiarity leaves the fish as it grows older, and that the sprat or garvie is really the young of the herring. Remembering the long ignorance of even the scientific in regard to the progeny of the salmon, we think it worth while that this statement shall be tested ; and having heard Professor Huxley arguing that the arche-

type of the human frame is that of the monkey, we presume that he, at least, will not be astonished if it be shown that the herring is merely a developed garvie.

There is another point as to which Government influence and encouragement may tell most beneficially upon the fisheries, as well as upon the hardy race of men by whom they are prosecuted with an amount of mortality which certainly should figure in the returns of the Registrar General as "preventible." Every now and then the voice of wailing is heard along our coasts because of that loss of the crews of fishing-boats which justifies the Scottish poet when he makes the fisherwoman say,

"Buy my caller herring;
Though ye may ca' them vulgar fairing,
Wives and mothers, maist despairing,
Ca' them lives of men."

We allude to the obstinacy of our fishermen in plying their hazardous calling in undecked boats. Caught in a storm, there are on the east coast few harbours into which they can run; and so these boats are driven helplessly out to sea, where they are swamped and lost, after the men have been exhausted in vain efforts to keep them to the wind in order to avoid shipping the broken waves which surround them. Heavily laden, a single wave may swamp them; and, when this casualty overtakes a whole fleet, the scene of misery which ensues is indescribably distressing. In 'Life in Normandy' there is a fearfully graphic picture of the agony of the watchers on the beach near a Scottish fishing village straining their eyes to catch a glimpse of what was befalling their nearest and dearest in mortal jeopardy on the raging sea. "Whisht ye," said an old woman to a boy crying aloud by her side; "keep yer greetin till its wanted; Lord knows but ye may be a faitherless bairn before mornin', and I a bairnless mither." Dismal foreboding sadly verified! Thirty-two boats were lost, and ninety-one poor fellows perished; and this was not all—numbers of the fishermen were ruined by the loss of their nets.

"All this loss of life and property arose from the boats being open; for every boat that was lost either foundered at its nets or was swamped in the sea. Had they been decked, the men could have hung on and taken their nets on board without fear of foundering. A few seas might break on board of them, but with a deck the boat would rise again as the sea rolled past. Give me a lid to the pot; and I wish I could only persuade our countrymen to be of my opinion on this subject and copy the Frenchman."

This wish is echoed by a Northumbrian fisherman with whom Mr Campbell has a most amusing colloquy:—"A Frenchman," quoth he, "is precious pig-headed, but I suspect our own people have a touch of the same nature too, for they will stick to the open

boats. They say the boats are lighter and more handy, if they have to take to the oars, when they have no deck ; and, no doubt, they are right in that, for a deck must always weigh something be it ever so light. But these Frenchmen shove along very well with their oars, and the devil's in it if a Scotchman cannot do as well as a Frenchman. It's prejudice and laziness that make them stick to a plan that risks their lives and properties far more than they need to do."

So long as they are so lazy and ignorant as they generally are, we shall speak to them in vain of the advantage of a small steam-tug being employed to convey with rapidity their boats to and from the spots frequented by the herring. And, we fear, it will be hard to teach them the value of life-buoys, or safety-belts, or persuade them to learn to swim. We have long been aware how few fishermen have acquired the art of swimming ; and being at sea in a herring-boat the summer before last, we had a curious talk with the crew on this matter. Being cold, we said to the friend who accompanied us, "Come, let's have a row." Being a clergyman, and, in the opinion of the fishermen, a land-lubber, of course, they were not a little surprised to see us set about rowing like men who knew how to manage an oar. "What are you staring at?" asks our reverend friend. "Oh, we never saw a minister rowin' a boat afore!" "Indeed! my father had more sense than yours, I suspect. He was a minister, but he taught me to do three things—ride, row, and swim. Can any of you swim?" "No, sir." "Why, man, if you fell out of your boat in smooth water even, you would be drowned!" "The Lord could save me, sir." "Oh, yes, He *could*, but He won't. Do you think He will work a miracle to save a man so lazy as not to have learned to swim?"

Though there must be great difficulty in either Government or private persons indoctrinating fishermen with ideas foreign to their experience and modes of thought, the effort to enlighten and assist them so far as proper should be perseveringly made. Government may regulate the size and equipment of their boats, and afford them the protection of large vessels and steamers at different points during the busy season, besides providing charts indicating the best fishing-grounds, and the nature of the tides, currents, &c. Above all, it is bound to be liberal in aiding the construction of harbours of refuge, the existence of which will go far to prevent those scenes of disaster which so often fill fishing villages with lamentation, and entail upon the poor-rates the heavy burden of maintaining families bereaved of the support wont to be supplied by the rough hands which laboured hard to "win the bairn's bread."

D. E.

THE FARMERS' NOTE-BOOK.—No. LXXIX.

Irish Agricultural Statistics.—The Abstracts of the Irish Agricultural Statistics for 1863 do not appear to bear out the views expressed by Dr Hancock, which were noticed in a recent number of this Journal. The capital of Irish farmers seems to be decreasing at an unprecedented rate, which must very soon lead to a serious crisis in the social relations of that part of the United Kingdom.

The cultivation of cereals again shows a large decrease, there being 144,719 acres less under that class of crops than there were in 1862. Turnip cultivation has also fallen off to the extent of 25,355 acres as compared with 1862, and that of mangold-wurzel to the extent of 6760 acres; while potato cultivation—the bane of Ireland—has increased 5514 acres over the previous year. There is also an increase of 8395 acres in the comparatively inferior class of root-crops included under the heads, cabbage, carrots, and parsnips. Against the decrease in cereals we have to place an increase of 63,922 acres of flax, that increase being confined chiefly to Ulster, which has always been a flax-growing province. We also find meadow and clover exceeding the returns for 1862 by 7724 acres. The entire area of the country is parcelled out in the following manner:—

	Acres.
Extent under crops,	5,661,179
Grass,	9,719,955
Fallow,	39,441
Woods and plantations,	318,760
Boag and waste unoccupied,	4,580,589
Total,	20,319,924

This is “exclusive of the larger rivers, lakes, and tideways,” which are not taken into the measurement.

The live stock has also again fallen off in point of numbers, there being 23,715 horses, 116,615 cattle, 152,201 sheep, and 89,522 swine fewer in Ireland than in 1862, a decrease in the stock of the country which is stated to be equal in value to £1,227,041. In 1859, the live stock in Ireland was valued at £35,368,259, while last year the total value was only £29,997,546, being a diminution of capital, in this article alone, of £5,370,713 in four years.

The emigration returns included in the Abstract refer only to the number of persons who emigrated from Ireland during the first seven months of the year. The total number during that period “amounted to 80,506, being an increase of 34,607 persons over the number who left the country during the corresponding period in 1862.” The Registrar-General adds, that “the entire number of emigrants from Ireland since the 1st of May 1851, when their enumeration commenced, amounts to 1,378,333.”

The extraordinary fact that a naturally fertile country, situated within a few hours' sail of the best markets for agricultural produce in the world, should be rapidly and continuously sinking in wealth, and fast becoming depopulated and waste, is well deserving of very serious consideration ; for unless some means are found to arrest Ireland's downward progress, it is but too evident that her condition will very soon be past mere speculation as to results. A very significant indication of the state of matters is to be found in the fact, that the "waste unoccupied" lands in Ireland have increased to the extent of 74,856 acres above the amount given in the returns for 1862. That such should be the case will doubtless appear strange to Scotch farmers, who have been doing so much to reclaim waste lands ; but that it is a fact the returns of the Irish Registrar-General sufficiently prove, and we have no reason to doubt its correctness, although it is a feature which seems to be very much overlooked by writers who profess to treat of the state of Ireland. The greatest increase of unoccupied land last year is shown in the returns from Munster—namely, 34,226 acres over the waste area returned in 1862 from that province ; Leinster follows with an increase of waste amounting to 19,928 acres ; then Ulster, with 19,241 acres ; while the least increase is shown to have taken place in Connaught, the waste lands of which were only 1461 acres more than in 1862, a circumstance which is doubtless owing to the operations of such men as Mr Pollok and others, who have been carrying on vast improvements on their estates in the west of Ireland.

AGRICULTURAL SUMMARY FOR THE QUARTER.

THE long-standing feud between the Germans and the Danes has at length broken out into open war, and a few fights, short but bloody, have taken place, ending in the Danes, whose courage is no match for the overpowering number of their foes, being driven into the remotest corner of Schleswig, behind their fortifications at Düppel. When the telegram brought the news of the first roar of cannon and the clash of swords, the hopes of the farmers rose high. They had visions of wheat rising from the wretchedly low figure of 40s. to 60s., 80s., mayhap 100s. per quarter—who could tell? for the beginning of war in these times is like the letting in of water, and all Europe might become involved. An old servant, as we saw it recently reported somewhere, while, along with his master, bemoaning the low prices, remarked, “Eh, mester, there’s naething for us noo but a guid European war wi’ a blessing;” and when the news of fighting came, the farmers saw in prospect the European war (it may come yet unfortunately), and, accompanying it, the blessing of dear wheat. But the buyers did not see, and up to this time have not apparently seen, with the same eyes, for the small advances at first gained under great difficulty have now been almost or entirely lost. Notwithstanding the excellent crop of the past year, farmers are continuing to feel the pressure of the times very severely, and perhaps they are more pinched now than they have been any time within the last twenty years.

The year opened with a hard frost, which continued about ten days, and enabled farmers to get on with the only farm work that was in arrear—viz., the carting out of manure. The weather since has been very changeable, frost alternating with rain, snow, and heavy gales. On the night of the 19th of February we had a slight sprinkling of snow; a considerable quantity fell on the 20th, and on the 21st there was a continued downfall, the snow at night lying several inches deep in country districts. The mass was further augmented by a fall on Monday, and the nights being frosty the snow lay almost unaffected by the heat of the sun. In hill districts there can hardly have failed to have been much loss among the sheep. All out-door operations have been completely suspended; and if the storm is of much longer duration, farm work, which is as yet well forward, will fall rather behind. A good deal of damage has been done to the turnip crop, a considerable portion having been still unstored when the frost came. As they have been a full crop, however, the loss will be less felt than it otherwise would have been. No doubt it is somewhat difficult at times for some farmers to secure their crops before severe weather sets in, but, as a rule, the majority might, by a due exercise of discretion and forethought, easily accomplish this. Year by year they have had the necessity of early storing

impressed upon them, not only in this Journal, but in most agricultural periodicals; and when people suffer from the neglect of good advice they do not deserve any great sympathy. Stock, as a rule, have been paying well, especially sheep; but there has been a good deal of disease, murrain, and also, in some quarters, pleuropneumonia, in cattle, and murrain in sheep.

The present year has been more than usually prolific in discussions on agricultural questions, and the discussions have been more than ordinarily exciting. Besides the topics on farming and farm practice in its various branches, which commonly form the principal talk in farmers' clubs, we have had, both in England and Scotland, since the new year came in, subjects of a semi-political character discussed with great vigour and warmth. To begin with England: we have had large and influential meetings for the repeal of the malt-tax, and these have been attended and concurred in by landed proprietors and members of Parliament. The agitation has not been confined to any particular district or shire, but has found active promoters in almost all the chief corn-growing counties. The most important gathering, however, was that at the Central Farmers' Club, where several very animated speeches were delivered, some of the speakers arguing for a total repeal of the tax, and threatening the members of their counties with expulsion at the first election if they did not strongly support these views. Now, no doubt, the abolition of the malt-tax would be a thing greatly to rejoice in if it could be accomplished without loss to the revenue; but considering that the impost yields something like £5,000,000 sterling per annum, it is difficult to see from what source a like sum could be derived. An addition to the income-tax seems the only readily available means to raise such a large amount, but few of us would care to have 5d. per pound added to what we already pay. The general feeling is rather in favour of reduction. It is indeed open to the Chancellor of the Exchequer to reduce the expenditure, but, having regard to the unsettled state of affairs on the Continent, with which at any moment we may find ourselves mixed up, we do not believe the country would sanction the withdrawal of funds from either the navy or the army. All, therefore, that the Chancellor of the Exchequer proposes to do in the matter is to get an Act permitting farmers to malt barley for feeding purposes. It has been asserted by many persons, on the strength of chemical analyses, that barley, in its natural state, contains far more nutritious elements than when malted, and, on this ground, even the small concession to feeders which the Government is ready to grant has been opposed. It is quite true that the opinion as to the less nutritive nature of malt is backed by such high names as those of Baron Liebig (who, however, appears to have somewhat modified his views), Dr Lyon Playfair, Dr Thomson of Glasgow, and others, but then the opinion has not been found in keeping with the actual experi-

ence of farmers who have made use of malt in feeding. In animal physiology, therefore, as in manures, it would appear that the teachings of chemistry require to be corrected by practical experiment. Among those who have tried and found malt superior to any other feed, are the renowned shorthorn breeder, Mr Booth of Warlabay; the almost equally well-known breeder of Leicesters, Mr Sanday of Holme, Pierrepont; that prince of farmers, Mr Hudson, Castleacre; Captain Davy, of Devon fame; and Mr Fisher Hobbs; and many more whom we need not particularise, but whose opinions were quoted at the Central Farmers' Club meeting. Mr Booth says—"Malt is superior to any other article for feeding cattle up to the very tip-top condition to which they require to be brought when they are intended for the show-yard." Mr Hudson remarks—"It is nearly eighteen years ago that I tried the experiment of fattening three Highland Scots upon malt, against three of the same lot upon barley-meal. The three fed on malt were decidedly the best beef when they went to London to be slaughtered." Mr Sanday, whose experience also extends over a number of years, says: "I am quite of opinion that if the malt-tax were taken off such a revolution would take place in our trade as we little think off. One great result would be the facilities we should have for growing beef and mutton at a moderate price. Linseed-cake would be greatly lowered in price, as well as all other articles used in feeding." Captain Davy had "seen it used with the best results to finish off fattening stock, and to animals a little off their feed; and, if it was cheaper, should prefer it to almost anything else." Mr Fisher Hobbs had used malt for twenty years, and had found it most beneficial, along with other food, not only in the case of cattle, but in that of sheep and horses. Most farmers, we think, will accept the evidence of these practical men as of more worth than that of the chemists, and will therefore conclude that malt is a highly valuable feeding substance. How far the bill brought in by the Chancellor will meet the views of those who have been taking the lead in the agitation against the tax, or how far it will tend to increase the use of malt for cattle, is a matter of doubt. So long as the tax remains unrepealed, there must necessarily be a good many vexatious restrictions hedging round and hampering the conversion of barley into malt for agricultural purposes alone; and such restrictions we of course find in the new Bill. We cannot afford space for it in full, but the following summary sufficiently indicates its character:—

1. Malt may be made duty free in feeding cattle.
2. Security to be given against fraud by maltsters.
3. Malting premises under the Act to be detached from other malt premises, and to be distinctly designated.
4. Malt to be conveyed from store to grinding-room under certain regulations.
5. A secure room for grinding and mixing to be provided.

6. Malt to be mixed with at least one-tenth of its weight of linseed-cake or meal.

7. An account of the mixed malt sent out, and names of persons to whom sent, to be kept.

8. All malt mixed with linseed will be considered as mixed under the Act, and the penalty for attempting to separate the ingredients, or to brew or distil therefrom, shall be £200 and forfeiture.

9. Persons removing unmixed malt from malt-houses licensed under the Act, or removing mixed malt at any but the specified hours, to be liable to the penalties of the 32d section of 18 and 19 Vict. c. 94.

10. Provisions of former Acts relating to maltsters and the making of malt to be applied to the purposes of this Act.

The stipulation that the free malt is to be made only in premises specially devoted to the purpose, must render the concession worthless in many thinly-populated districts, where it is not likely any one will be found to risk the necessary capital on such an establishment, especially when the Act, if passed, is to remain in force for only two or three years. The 'Mark Lane Express,' which has been the chief organ of the agitation, does not at all approve of the Bill; its observations upon it being—"It finds but little favour in the country. It is pretty generally pronounced impracticable in its conditions, and absurdly inquisitorial in its enforcement. The farmer will be continually under the eye of the exciseman, whilst notices and attendances promise to render the operation of such a privilege more obnoxious and more expensive than ever." This is not encouraging language for Mr Gladstone to proceed with his measure in its present form.

In Scotland the malt-tax has excited but little interest; but another semi-political subject has aroused fully as much feeling, and has been discussed as eagerly as the malt-tax in England—we mean the law of hypothec. This has long been regarded as a subject of grievance by all tenants of intelligence and means, inasmuch as the security it gives the landlord enables him to let farms without fear of money loss to men of little capital, less practical knowledge, and no scruples as to getting into the debt of the manure-dealer, seed-merchant, and cattle-agent, which, of course, is highly disadvantageous to the honest, substantial, and experienced man. The subject has, at various times, been often agitated before, but as often allowed to drop, partly because landlords, as a whole, are much better than the law, and partly because small and needy farmers, thinking it was beneficial rather than injurious to their interests, either gave only a half-hearted support to the movement for its modification, or opposed it altogether. What has brought it before the public just now was an attempt to stretch it to its utmost and harshest limits, though the attempt was defeated by a jury, who, however, it must be said, appear to have been actuated more by their notion of what was right and fair, than by the law of the case. The history of the matter is briefly this:—In Novem-

ber 1858, W. M'Culloch and Adam M'Kerrow entered as conjoint tenants the farm of Hobsland in Ayrshire, belonging to Mr Graham Burns, on a twelve-years' lease. Whether through lack of the necessary capital to begin with, or whether on account of taking the farm at a rent above its value—no uncommon occurrence in these times—the tenants, at the end of four years, found it necessary to throw up the farm. The rent for the crop of 1862 was due, and the landlord sequestrated them on the 15th December. Shortly before this date the Messrs Allan, large meal-merchants in Ayr, had purchased a quantity of meal from M'Culloch, with whom they had been in the habit of doing business for many years. They purchased it in perfect good faith, giving him full market value for it, and in the same open way in which they carry on all their transactions. They had no reason whatever to believe that M'Culloch was in bankrupt circumstances; indeed they, along with most of the traders in Ayr, considered him well to do. However, on M'Culloch being made bankrupt two or three weeks after the purchase, the landlord applied to the Messrs Allan for a repetition of the price of the meal; and on their refusal, the case was brought before the Court of Session. It was not denied by the defendant's counsel that the landlord's right of hypothec extended to all grain not purchased in the open market, even when bought in the most *bona fide* manner, and even to grain purchased in the open market by sample instead of bulk. The purchasers of grain in all sample markets in Scotland can be called upon and forced by the landlord to pay over again to him the price which has been previously paid to a tenant who has become bankrupt weeks after the transaction. But it was contended that the landlord's right did not extend to grain after it had been manufactured into meal, not in a private manner, but at a public establishment; and that even if it did, the meal having been sold in bulk at what was practically a public market—in fact, the only kind of market at which such sales are made in Ayr—the provisions of the law were not violated. The charge of the judge was against both pleas, he holding that the grinding of corn did not abrogate the landlord's right under the law of hypothec, and that a meal store could not be called a public market. The jury, however, as we have said, decided in favour of the defendant. But although the case went against the landlord, it was generally felt that the decision might be overturned on review, and that even if it were not, that the law still left too much power in the landlord's hands. It was thought unwise to leave so much discretionary power in the hands of proprietors; that although, as a rule, they very rarely put the law in force in a harsh way, yet it would be better to have a law based on honest commercial principles than to rely upon the generosity of any class of men. Accordingly, a meeting to take into consideration the desirability of reforming the law was called in

Ayr, and it was numerously attended, not only by the most influential tenant-farmers, but also by landlords—one of whom, owning about the largest estates in the county, occupied the chair. The present movement, therefore, is not one arising out of any class feeling. It is not got up by discontented demagogues eager to create variance between landlord and tenant; but, on the contrary, by men who are anxious to remove any causes of misunderstanding between the two classes, and so draw the relationships closer together. Mr Oswald of Auchencruive, who was in the chair, while declining to commit himself to any course in the matter, yet expressed an opinion that the law, as laid down in 1828, and which decided that the buyer was liable to repeat the price of grain bought by sample in open market at a fair price, was unjust. Sir James Fergusson was rather in favour of the law of hypothec, as its existence enabled landlords to trust farmers longer than they would otherwise be disposed to do; but he seemed to forget that such long trust was highly detrimental to another class of creditors—the grain-merchants, manure-dealers, &c., without whose aid the land would be comparatively worthless to either landlord or tenant. But Sir James, nevertheless, confessed himself ready to give any proposed amendment a fair and impartial consideration. No opposition was offered on the part of any present to the resolutions, the most important of which was, “That the present state of the law of hypothec is unsatisfactory, and that it is the opinion of this meeting that measures should be taken for its amendment.” Following upon the Ayrshire meeting, there was one at Dundee of a still more influential character. Here again there was a landed proprietor, who was also an M.P., in the chair, and he was countenanced by many of his brother landlords; and others, who were unavoidably absent from the meeting, sent in letters approving of the movement. The same harmony of feeling between land-owners and tenants which was seen at Ayr was also displayed at Dundee, where the former went even farther in favour of the amendment of the law than in the land of Burns. The speeches made by the tenant-farmers at Dundee were very telling—some glaring instances of its iniquitous working having occurred in Forfarshire. The resolutions moved at the Dundee meeting were carried with the greatest unanimity. They were, first, to the effect that the law of hypothec as it stands is injurious to the mercantile classes doing business with agriculturists, and not only adverse to the interests of the community, but also to those of landlord and tenant; and, second, “That, in the opinion of this meeting, it is desirable that no time should be lost in remedying the defects of the present state of the law; and that a committee be appointed to draw up petitions to both Houses of Parliament in favour of its amendment, and generally to promote whatever measures may be proposed for this object.”

The chairman, the Honourable Mr Carnegie, M.P. for Forfarshire, has since moved in the House of Commons for a select committee to investigate the subject, with a view, it is presumed, of legislation after their report. The Earl of Dalhousie is also quite in favour of a change in the law. At the Dundee meeting a letter was read from him, in which he said: "I am quite prepared to advocate a change in the present law of hypothec, and even to abolish it altogether, provided the tenant shall be obliged to find good security to his landlord for whatever may be due to him. This is asking nothing more than what is required in all commercial transactions, and ought not to be objected to. I quite approve of the resolutions you have sent me. This is one of those questions which, when once in motion, should be steadily followed up, so that the interests of all parties—landlord, tenant, and merchants dealing with tenants—may be placed in a position equally fair to all." In other counties of Scotland, although no action has as yet been taken in the matter, we are aware that the feeling against the law of hypothec is equally strong. For our own part, we think that Lord Dalhousie has placed the matter in its true light. If the law of hypothec is to be abolished, the landlord must have another law which shall insure him getting his rent paid. But this new law, if new law we are to have, should be of such a nature as to render it imperative upon the landlord to look well to the means and capabilities of the tenant before he let him a farm. It should not give advantage to men of small means and without practical experience, as the present law has undoubtedly done, over men of capital who have spent their lives in farming pursuits. We do think that the present law of hypothec tends to injure the honest agriculturist, in so far as it enables the landlord to let his farm without the slightest risk to the man who offers the largest sum, even although he had little money and less knowledge of farming. On the strength of having a good farm, the manure-dealers, driven by close competition, are only too ready to supply him with their goods, the seed-merchants and cattle-agents are equally liberal; and when bankruptcy comes, as come it must, the landlord, instead of being a loser, is sometimes a profitter by such a tenant, as he gets his land put in good heart at the expense of the too confiding manure-dealer. We are far from saying that the generality of landlords always let their land to the highest bidder, but too often the best must be influenced by the high rates they read of their neighbours getting, and are so led, through their agents knowing their security, to prefer an unpractical man at a high rent to an experienced man at a fair one. Such a guarantee as Lord Dalhousie desiderates would be an effectual preventive of men entirely without capital, or with insufficient means, getting a farm in preference to others who possessed the requisite amount of money as well as the knowledge to carry on farming "according to the rules of good husbandry." It would insure that the land should not be

raised by the offers of competitors who are really, if we look at the matter in its true light, no better than those persons who, by their mock bodes, raise the prices of goods at auction sales against the *bona fide* buyer.

In Stirling there has been a meeting of farmers to discuss "the present state of agriculture, its grievances and hindrances." We cannot say that this meeting was likely to be of much benefit to farmers. There was a great want of practical suggestions in the speeches. Nobody appeared sure as to what was the real grievance, whether it was the law of hypothec, the game-laws, the high rents, or the large imports of grain from the Continent. There was no definite resolution come to, but it was generally understood that there should be an appeal *ad misericordiam* made to the landlords. There was a want of dignity about the meeting. When farmers take their farms, if they are business men, they should strike an average of bad seasons and good seasons, and make their terms accordingly. We do not think it is likely any of them would go to the landlord and say, "We have had an immense crop—far more than ever we anticipated—and therefore we deem it only right that we should share the profits with you;" and if they would not do so, we do not see why landlords should be expected to make a reduction to them in a bad year. If they pay too dear for their whistle they ought to bear the loss, as Franklin did. Indeed, we believe that a good many of the evils of which farmers have now to complain have been brought about by their trusting to the landlord deducting a portion of their rent if they found themselves unable to meet it. When this is done—and we know it has been done pretty frequently—the public never hear about it, but they know all about the high rent that is nominally paid; consequently, not being aware of the generosity of the landlord, and supposing that the rent is always duly met, others come into the land market and offer terms in proportion; and so land has crept up gradually, until, in many parts of Scotland, it is now far beyond its value.

Another subject which has been occasioning considerable interest among our Scotch farmers, is the proposal to establish a Chamber of Agriculture and Central Farmers' Club in Edinburgh. The necessity for such an association, and its objects, are so well put in a letter to the 'Scotsman,' that we need make no apology for quoting it. The writer says:—

"It is a curious fact, that by far the most important interest in the country—the foundation, indeed, of all other interests—the agricultural, has no representative body specially charged to look after its welfare and challenge existing abuses, to check the perpetration of new ones, and to promote reform. Almost all other trades and professions have their corporations, their associations, and chambers, whose duty it is to watch over every bill affecting their interests introduced into Parliament, to offer the most strenuous opposition to all clauses likely to be detrimental to, and to be equally energetic in their support of those calculated to have a favourable influence on,

their particular branch of manufacture or commerce. But farmers, with a hundred times larger stake in the country than any other body of men, are content to take the good, bad, and indifferent which the Legislature gives them, with, as the case may be, weak and ineffective shouts of approval, or equally futile grumbling, because both lack the strength which union secures. In their present isolated position they are almost as helpless as the children who "shut their eyes and open their mouths to see what Heaven will send them," and Heaven is proverbially not kind to such credulity and supineness.

"This unwonted apathy is no doubt partly to be accounted for by the fact that, before railways existed, farmers had little opportunity of meeting other agriculturists save those in their own immediate neighbourhood; and, under such circumstances, topics of purely local farming would naturally seem, as no doubt they were, the most profitable to discuss. Half-a-dozen farmers in the market inn settling questions of national import would certainly have borne a strong resemblance to the three renowned tailors of Tooley Street. But with the opening of railways all this was changed; and farmers in all the principal agricultural counties of Scotland can almost as readily, and with as little trouble, meet at any central point (like Edinburgh, for instance), as merchants can converge from adjoining streets in the same city. There is, therefore, nothing now to prevent them having an organisation similar to our Chambers of Commerce, but those little petty jealousies and animosities which, I am sorry to say, are too common among farmers. But it is more than foolish to allow these to interfere with their individual and general interests. Merchants and tradesmen might be supposed to have greater cause for distrust and suspicion towards one another than farmers, for they come far more directly into competition; but we find them readily surrendering these feelings for the good of all, which is also the profit of each.

"I notice with satisfaction that one of the agricultural papers has been advocating, in accordance with the suggestion of Mr M'Lagan of Pumpherston, the establishment of a Chamber of Agriculture and a Central Farmers' Club in Edinburgh. This institution, it is proposed, should embrace farmers from all districts of Scotland, and its duty should be to take cognisance of all measures affecting the agricultural interest, and to discuss and agitate for the amendment or abolition of such laws as bear hardly on the farmer—as the law of hypothec, restrictions in leases, the game-laws, &c. It is also suggested that a seed and root show, as well as a fat cattle show, both of which are well calculated to promote the cause of agriculture, should be held in Edinburgh under the auspices of the association. Such a club, it is stated, could be made to clear itself were 400 or 500 members each to subscribe one guinea per year. There are between 40,000 and 50,000 farmers in Scotland; all who are connected with the cattle, manure, and seed trades are equally interested in such a society, and if from among all these parties a sufficiency of members cannot be obtained, all that I have got to say is, that agriculturists have no right to complain of their grievances, or cattle and manure dealers to anathematise the law which places them at the mercy of the landlord."

From all we can learn, the most eminent farmers in all districts of the country quite approve of such a club, and not a few proprietors also; and all that now seems wanted to make it a success is, a meeting for the appointment of directors, &c.

It will be seen from the above remarks that "the agricultural world," as it is called, has not been lacking in interest since the new year came in. There has also been a vast amount of excitement

about the comparative value of manures, arising out of an advertisement about phospho guano, which was supposed by dealers in other manures to depreciate unduly the merits of that most important of all artificial fertilisers, Peruvian guano. The battle of the manures waged so fierce and deadly, that at last it was found necessary, by the Highland Society, to call their chemist, Professor Anderson, into the arena, who, by the way, had somewhat committed himself as an advocate of the phospho guano. It appears, from his explanations, that he does not hold that there are only 7 per cent of ammonia in Peruvian guano, as his report quoted in the advertisement of phospho guano (and which was really a statement made in a court of justice, where he had no means of modifying or explaining his meaning) would make it appear, but that his opinion is that there are practically 17 per cent of ammonia available for plants in the Peruvian guano. We are not sure, however, that his explanations threw much light upon the vexed question as to the best and cheapest manures. Indeed, so far as the lecture taught anything, it was to the effect that it would be very dangerous to trust to chemical analysis as a guide to the proper value of any artificial fertiliser in the market. In fact, to quote a somewhat hackneyed couplet anent the lecture—

“ The Rev. Mr Parker made that darker,
Which was dark enough without.”

Then at the Highland Society's annual meeting, at which we noticed the presence of Prince Alfred, and at which his royal brother—who promises to take as much interest in agricultural pursuits as his lamented father—was elected an honorary member, we had much livelier entertainment than usual. As a rule, the meetings of the Society are somewhat tame and monotonous—no doubt owing to the admirable manner in which the whole business is arranged before it comes under the cognisance of the meeting. On the last occasion, however, the sameness was broken by Mr Harvey, of Whittinghame Mains, questioning Dr Anderson about the report as to phospho, to which we have already referred. Then on the question of agricultural education we had a discussion which, if not very profitable, was at least very personal.

But besides these (to adopt a phrase from the ‘Times’) extra agricultural utterances, we have had fully more than the usual amount of discussion on practical questions in farmers' clubs. At the *Winfrith Farmers' Club* there was a paper read “On the Improvement of Meadow and Pasture Land,” by Mr Longman of Bell-mish. Mr Longman began by pointing out the importance of our meadow and pasture land, which extended to more than half the area of the United Kingdom, and their importance was rendered all the greater at the present time from the high price of beef and mutton and the low price of corn. He also expressed an opinion to

the effect that we paid far too little attention to improving the pasture, our efforts being almost wholly devoted to the arable land. Mr Longman laid great stress upon the necessity of thoroughly draining all our boggy meadows. He also recommended various kinds of manurial substances for grass—chalk being good on heavy soils and marl on lighter lands. Rough and coarse herbage might be improved by the application of 5 cwt. of salt per acre, sown broadcast. In some cases, where the pasture is very foul from weeds and moss, he said it would be

“Advisable to pare and burn the old sward, and re-sow the land entirely; but in most cases great improvement can be effected by merely sowing renovating seeds, which should consist of the finest and most nutritive kinds of perennial grasses and clovers, in the following manner:—Heavy harrows should be drawn over the old turf early in the spring to loosen the soil for the admission of seeds, which, if sown freely, will occupy the numerous small spaces between the grasses already growing, and supersede the coarse grasses and noxious weeds. It is a good practice to sow these seeds at the same time as the top-dressing, if any is applied; but this is by no means necessary. The months of February, March, and April are proper for sowing the seeds; the earlier the better, as the old grass will protect the young from frost. It is also useful to sow in July and August, immediately after carrying the hay. Should the old turf be very full of moss, this is generally an indication that draining would be beneficial. The following is, however, an almost infallible remedy for the moss—not only destroying it, but preventing the growth in future. Mix two cartloads of quicklime with eight cartloads of good light loam, turning the compost several times that it may be well mixed and the lime slaked; spread this quantity per acre over the pasture, dragging the turf well with iron harrows. Cattle should not be allowed to graze at the same season as this dressing is given, or, at least, not till after one crop of hay is taken from it.”

The members of the Club generally agreed with Mr Longman that pastures were too much neglected, and with his recommendations for improving them. The advice is useful nearer home than at Wool, where the lecture was delivered; and those of our readers who wish fuller information on the subject will find it in a clear and practical paper in the number of this Journal for October 1863. At the *Dorchester Farmers' Club*, Mr Spooner of Eling read an elaborate paper “On the Influences that govern the Growth of Root Crops,” but its interest was rather of a scientific than practical nature, and some of his statements with regard to the application of phosphates were, we think, of too absolute a character. But perhaps the most practical and valuable paper read during the quarter was one “On the Breeding and Rearing of Sheep,” by Mr Henry Woods, who, as manager to Lord Walsingham, has raised that nobleman's southdown flock to a pitch of excellence almost unrivalled. It was delivered before the members of the *Wayland Agricultural Association*, and embraced almost every point in connection with a flock about which sheep-breeders care to know. The lecture was far too elaborate to be

entered into in this part of the Journal, but the following heads will show the exhaustive character of the paper :—

1. The ewes to breed from.
2. The rams to use ; how to use them ; and when to put them to the ewes.
3. Treatment of ewes during pregnancy ; abortion—its causes and effect.
4. Treatment of ewes during the lambing season.
5. Management of lambs when on the ewes, and when weaned.
6. Hoggets—their treatment from July to Michaelmas.
7. When on turnips, and their treatment thereon.
8. Whether most profitable to sell in or out of their wool.

When we have said that the subject was ably handled under the various heads, we have said enough to induce those of our readers who take an interest in the “woolly people,” to turn to the lecture itself, which will be found at length in any of the agricultural newspapers of January’s date. A very elaborate and sensible paper was read by Mr Lamport, before the *Wigton Farmers’ Club*, urging the introduction of the partnership system into agriculture. He adduced many excellent reasons for his belief that farming could be much more profitably carried on by a division of labour, but some of his advice was impracticable. The *Galashiels Farmers’ Club* had a discussion as to “whether, in present circumstances, it is best to farm by the five or six years’ shift ;” but after remarks from several members, some of whom were in favour of the five and some of the six years’ course, the Club, on a vote, was equally divided, and it was generally agreed that the difference in soil and climate might make the shorter rotation better under some circumstances, and the longer one better in others. At the *Fettercairn Farmers’ Club*, a paper was read by Mr Johnston on “Altered Tillage and Rotation in reference to the Grub-worm,” the paper being a sequel to the admirable one on the grub, read by Mr Scroggie at the previous meeting, and noticed in last Quarterly Journal. The lecture was rather discursive, and embraced the application of manures for the destruction of the grub (most of which have proved quite ineffectual), the pulverisation of the soil for the same end, as well as the alteration of shifts. What Mr Johnston proposed was to have a seventh rotation or eighth rotation according to the quality of the grass land. Thus, where grass land was not so good, he proposed—1, grass ; 2, grass ; 3, whole field potatoes, beans, tares, cabbage and rape ; 4, oats ; 5, barley and oats ; 6, turnips ; 7, barley with grass-seeds sown down. In the case of the grass being good, he recommended three years’ grass, the rotation then to go on as before. In the event of the landlord objecting to the tenant taking two cereal crops in succession, the seventh rotation would, as a matter of course, resolve it into a sixth, and the eighth into a seventh. We may just note that some interesting experiments with different kinds of manures on the turnip crop have been made public by the *East Lothian Agricultural Club*, and also

by the *Western District of Mid-Lothian Agricultural Association*. In the East Lothian experiment we have no general summary of results, and the individual evidence is rather conflicting. Mr M'Lagan of Pumpherston has, however, given the results of three years' experiments in the Western District in a quotable form. They are as follow :—

“Last year the results were decidedly in favour of Peruvian guano, as compared with the mixtures which proved more successful in the two previous years, particularly when the price of the manures was taken into account; and when we take the average of the results of the three years, it is in favour of the mixtures, the price being considered also thus :—

Average produce per Acre from 6 cwt. of Peruvian guano, at 78s. per Acre.				Average produce per Acre from 6 cwt. of mixture, consisting of 1½ cwt. of nitrate of soda, 2½ cwt. of Bolivian guano, and 2½ cwt. of superphosphate, at 55s. 8d. per Acre.		
Year.	tons.	cwt.	qrs.	tons.	cwt.	qrs.
1861, . . .	20	11	1	22	5	1
1862, . . .	16	7	2	16	6	5
1863, . . .	26	14	0	21	15	0
Average,	21	4	1	20	2	2

Certain experiments were also undertaken last year, by members of the Western District Association, with a view to determine the important question whether superphosphate manufactured from bone or animal substances is more valuable than that from a mineral origin, the degree of solubility being the same; and also whether the value of a superphosphate was in proportion to its degree of solubility. These experiments we find thus summed up by Mr M'Lagan in M'Lean and Hope's Catalogue for 1864, which contains much suggestive and useful information for farmers :—

“These experiments indicate that the manurial effects of the superphosphates do not depend so much upon the source from which the phosphates have been derived when rendered soluble by acid. For instance, we find a mineral superphosphate giving us a larger crop than a bone superphosphate in one experiment, and almost an equal crop in another. The experiments also prove to us that the manurial value of a superphosphate is not always in proportion to the amount of soluble phosphates it contains, and that it is possible to manufacture superphosphates up to a point of solubility which may make the manure less valuable than if the proportions between soluble and insoluble phosphates were about equal; because, in a manure containing a large percentage of soluble phosphates, it is necessary to use so much more sulphuric acid, which is probably less valuable to the farmer than a lesser quantity. This remark, it must be understood, can only apply to phosphates made from bone or animal substances, as it is well known insoluble mineral phosphates can supply little, if any, manure, and it is doubtful if the action of the soil will ever render these soluble.”

In connection with the relative value of phospho and Peruvian

guano, Mr Drennan, Holmston, Ayr, has supplied the 'Scottish Farmer' with the result of some carefully conducted experiments with these and other artificial manures on the oat and turnip crops. This subject is so important just now that our readers will thank us for quoting the principal part of Mr Drennan's report.

"The experimental lots contained two 15-foot ridges each. The calculations were made by the Scotch acre, as the measure with which farmers in the west of Scotland are most familiar. One lot was dressed with Peruvian guano at the rate of 2 cwt. per Scotch acre; a lot on one side with phospho guano, at the rate of 2 cwt.; and a lot on the other side with a mixture composed of five parts phospho guano and one part sulphate of ammonia, at the rate also of 2 cwt. per Scotch acre. According to the published analysis, the phospho guano contained $3\frac{1}{2}$ per cent of ammonia, and as the sulphate contained 25 per cent, the manure applied to lot 3 would have about 7 per cent of ammonia.

"The oats were distributed with a broadcast machine on the 27th March, and the manures were sown carefully with the hand at the same time. Findlay oats were sown—a variety of long oats which, after trials of other kinds, is generally fallen back upon as the most profitable in Kyle and Cunningham.

"March was a good month in Ayrshire; but the weather was most unfavourable in April and the first three weeks of May. The rainfall was heavy, and the temperature low. There was little growth of grass, and wheat did not tiller well, notwithstanding its unusually fine appearance in the early part of April. The oat braird, therefore, came very slowly. To quicken it, sulphate of ammonia was applied to the greater part of the field on the 13th May, at the rate of 1 cwt. per Scotch acre. Two ridges next to the other lots were top-dressed in this manner, and formed lot 4 of the experiments. The adjoining ridges, to which no dressing whatever was applied, made a fifth lot.

"No. 1, manured with phospho guano, and No. 3, with the mixture of phospho guano and sulphate of ammonia, were two or three days earlier in ear than Nos. 2 and 4, dressed respectively with Peruvian guano and sulphate of ammonia. Nos. 1 and 3 were three or four days sooner ready for reaping. No. 3 seemed the heaviest crop during the season. No. 4 was far behind the other manured lots at the second week of June, but it gained upon them afterwards until the growth was checked by the drought in July.

"The grain was stacked in dry condition, and was thrashed when the bustle of harvest-work was over. Oats have fallen in price since that time, and straw has risen in Ayrshire. The statement of the value of the different lots would not be much altered if the calculations were made by present rates. The straw was valued at 35s. per ton, and the light oats at 14s. per quarter. The following figures give the results of the experiments:—

No.	Bushels per Acre.	Weight per Bushel.	Value per Quarter.	Light Oats, Bush.	Straw, &c. Cwt.	Total value.	Cost of manure.	Profit.
		lb.				£ s. d.	s. d.	£ s. d.
1	70½	36½	18 6	10½	55	13 17 7½	23 0	1 7 6½
2	81	36	18 0	12	60½	15 9 1	26 0	2 16 0
3	76½	37	19 0	11	55½	14 19 3	24 6	2 7 8
4	68	36½	18 9	10½	51½	13 7 5	16 0	1 4 4
5	57½	36½	19 3	10½	44½	11 7 1	...	...

"In this instance, Peruvian guano, weight for weight, has given twice as much profit as phospho guano; and, notwithstanding the 'deliberate

opinion' of Dr Anderson as to 'the favourable relation between the phosphates and ammonia' in the phospho guano, the effect of doubling the proportionate amount of the ammonia in No. 3, as compared with No. 1, is to add about 75 per cent to the profit.

"I made likewise a few experiments with manures in the growth of turnips on a friable loam at the same altitude as the oat field. The land was well dunged for potatoes in 1861, and cropped with wheat in 1862. Although it had been ploughed deep in the beginning of winter, it was difficult to prepare for turnips in May, in consequence of the long-continued rains, and the work was rather late of being done. The seed was put in on the 2d of June, which is late for swedes. The lots contained four drills each. No. 1 was manured with a mixture of three parts of a coprolite manure made by Mr Weir, Ayr, and one part of sulphate of ammonia; No. 2 with Weir's coprolite manure; No. 3 with Lawes' turnip manure; No. 4 with phospho guano; No. 5 with Peruvian guano. The price of Weir's manure was £5, 10s., and Lawes' £6, 10s. per ton. Equal weights were applied to each one of the five lots—namely, $7\frac{1}{2}$ cwt. per Scotch acre. No. 6 was manured with 5 cwt. of Peruvian guano, and No. 7 with 5 cwt. of phospho guano.

"The turnips brairded regularly, but they made wonderfully little progress for a long time. No. 1 was first ready for singling, and No. 5 next. Nos. 2 and 3 looked ill for a long time, but No. 2 improved considerably in autumn. None of the lots covered the ground till the season was too far advanced for the chance of a good crop. The turnips were pulled and carefully separated from tops and roots on the 27th November. The following is the cost of the different manures and the weight of the bulbs:—

No. 1,	.	.	Price of Manure.	Weight of Crop.		
				tons.	cwts.	qrs.
No. 1,	.	.	£3 1 0	18	12	0
" 2,	.	.	2 1 3	16	18	1
" 3,	.	.	2 8 9	13	4	3
" 4,	.	.	4 6 3	16	7	0
" 5,	.	.	4 17 6	22	3	1
" 6,	.	.	3 5 0	19	3	2
" 7,	.	.	2 17 6	16	4	1

"In these experiments, No. 4, with $7\frac{1}{2}$ cwt. of phospho guano, gives little more weight of crop than No. 7 with 5 cwt. Before the turnips began to grow freely, the season was so far advanced that a large supply of phosphates could not give an adequate return. Weir's coprolite manure was said to contain from 25 to 28 per cent. of soluble phosphates, and only a small quantity of organic matter from horns, hoofs, and other substances, which, like coprolites, require large quantities of acid to reduce them."

AVERAGE PRICE OF THE DIFFERENT KINDS OF GRAIN,

PER IMPERIAL QUARTER, SOLD AT THE FOLLOWING PLACES.

LONDON.								EDINBURGH.							
Date.	Wheat.	Barley.	Oats.	Rye.	Pease.	Beans.		Date.	Wheat.	Barley.	Oats.	Pease.	Beans.		
1863.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.		1863.	s. d.	s. d.	s. d.	s. d.	s. d.		
Dec. 5.	46 5	33 10	20 5	31 8	35 1	33 8		Dec. 2.	43 2	29 8	20 11	36 3	35 6		
12.	45 1	35 2	22 0	32 4	37 2	31 8		9.	41 6	28 11	20 9	37 8	36 9		
19.	47 3	34 6	20 8	32 9	32 3	32 1		16.	39 1	28 8	20 8	34 9	35 6		
26.	45 8	34 0	22 2	33 6	33 8	34 4		23.	38 8	28 0	20 0	33 9	33 6		
1864.								30.	39 2	28 2	19 11	31 8	30 10		
Jan. 2.	46 7	31 9	21 4	30 6	32 1	33 8		1864.							
9.	43 2	34 0	20 5	29 7	33 3	34 2		Jan. 6.	39 5	29 7	19 11	34 0	33 6		
16.	43 1	35 1	18 8	29 6	33 6	34 8		13.	39 11	28 11	19 7	32 6	32 0		
23.	44 4	37 0	19 11	28 10	32 10	34 6		20.	38 10	29 0	19 10	31 10	31 6		
30.	46 5	32 8	19 9	29 4	32 6	33 9		27.	39 0	28 8	19 7	32 0	31 8		
LIVERPOOL.								DUBLIN.							
Date.	Wheat.	Barley.	Oats.	Rye.	Pease.	Beans.		Date.	Wheat.	Barley.	Bere.	Oats.	Flour.		
									p. barl.	p. barl.	p. barl.	p. barl.	p. barl.		
									20 st.	16 st.	17 st.	14 st.	9 st.		
1863.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.		1863.	s. d.	s. d.	s. d.	s. d.	s. d.		
Dec. 5.	40 10	31 2	18 10	29 6	34 2	39 4		Dec. 4.	24 0	15 6	14 0	13 0	19 4		
12.	38 8	30 8	24 2	29 10	33 6	35 10		11.	23 6	15 6	14 3	12 5	19 2		
19.	44 7	30 0	20 2	29 4	33 10	32 6		18.	22 6	15 2	14 8	11 6	19 0		
26.	39 9	31 3	20 0	28 8	33 5	34 4		25.	22 0	15 0	14 5	10 9	18 10		
1864.								1864.							
Jan. 2.	37 5	30 10	29 3	28 4	33 10	34 8		Jan. 1.	22 10	15 4	14 0	10 5	18 6		
9.	40 9	29 9	21 8	29 2	33 6	34 4		8.	22 6	15 2	14 1	10 6	18 8		
16.	42 7	33 7	24 9	29 6	32 6	33 10		15.	23 0	15 9	14 2	10 8	18 7		
23.	40 7	32 8	20 2	30 2	32 2	33 6		22.	23 6	15 4	13 10	10 6	18 8		
30.	39 4	30 6	20 7	30 8	33 4	34 8		29.	24 6	15 8	14 2	10 8	18 9		

TABLE SHOWING THE WEEKLY AVERAGE PRICE OF GRAIN,

Made up in terms of 7th and 8th Geo. IV., c. 58, and 9th and 10th Vict., c. 22. On and after 1st February 1849, the Duty payable on FOREIGN CORN imported is 1s. per quarter, and on Flour or Meal $4\frac{1}{2}$ d. for every cwt.

Date.	Wheat.		Barley.		Oats.		Rye.		Pease.		Beans.	
	Weekly Average.	Aggregate Average.	Weekly Average.	Aggregate Average.	Weekly Average.	Aggregate Average.	Weekly Average.	Aggregate Average.	Weekly Average.	Aggregate Average.	Weekly Average.	Aggregate Average.
1863.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
Dec. 5.	40 9	40 1	33 6	33 10	19 5	19 2	29 7	29 2	33 7	34 2	35 3	35 10
12.	41 4	40 1	32 10	33 8	19 3	19 3	29 11	29 6	34 2	34 2	34 11	35 8
19.	41 2	40 6	32 6	33 5	19 0	19 4	29 4	29 8	33 7	33 11	34 9	35 6
26.	40 5	40 7	32 0	33 1	19 0	19 4	29 6	29 9	33 6	34 1	34 7	35 4
1864.												
Jan. 2.	39 10	40 7	31 8	32 8	18 9	19 2	29 5	31 2	33 2	33 8	34 6	34 10
9.	40 2	40 7	31 7	32 4	18 8	19 0	29 7	30 4	33 3	33 7	34 2	34 6
16.	40 11	40 7	31 10	32 1	18 10	18 11	28 0	30 1	33 0	33 6	33 7	34 3
23.	41 3	40 7	32 5	32 0	18 9	18 10	28 0	29 9	32 8	33 2	33 8	34 0
30.	40 8	40 6	32 1	31 11	18 11	18 10	31 8	31 1	32 10	33 1	33 8	33 9

FOREIGN MARKETS.—PER IMPERIAL QUARTER, FREE ON BOARD.

Date.	Markets.	Wheat.				Barley.				Oats.				Rye.				Pease.				Beans.			
		s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.
1863. Dec. ..	Danzig	21	6	26	6	15	0	18	6	11	6	14	6	17	6	21	0	24	6	28	6	25	0	29	0
1864. Jan. ..		20	6	25	6	14	6	18	0	11	0	13	6	16	6	20	0	23	6	27	0	24	6	28	0
1863. Dec. ..	Hamburg	22	6	28	6	14	6	17	6	11	6	14	6	16	6	20	6	24	0	28	0	24	6	28	6
1864. Jan. ..		21	0	27	6	13	6	16	6	11	0	14	0	16	6	21	0	25	0	29	0	26	0	29	6
1863. Dec. ..	Bremen	21	6	27	0	14	0	17	6	11	0	14	0	16	6	21	6	24	0	27	6	25	0	28	6
1864. Jan. ..		20	6	26	6	14	0	18	0	11	6	14	6	17	0	21	0	25	0	28	0	26	0	29	0
1863. Dec. ..	Königsberg	22	6	28	6	15	0	18	6	11	6	14	0	16	6	21	0	24	6	28	0	25	0	29	0
1864. Jan. ..		21	6	27	6	14	6	18	0	11	6	14	0	17	0	21	6	25	0	28	6	26	0	29	6

Freights from the Baltic, from 5s. to 7s. 6d.; from the Mediterranean, from 10s. 6d. to 15s.; and by steamer from Hamburg, from 5s. to 8s. per imperial qr.

THE REVENUE.—FROM 1ST OCTOBER 1863 TO 31ST DECEMBER 1863.

	Quarters ending Dec. 31.		Increase.	Decrease.	Years ending Dec. 31.		Increase.	Decrease.
	1862.	1863.			1862.	1863.		
	£	£	£	£	£	£	£	£
Customs	6,320,000	5,970,000	..	350,000	24,036,000	23,421,000	..	615,000
Excise	4,000,000	4,753,000	753,000	..	17,534,000	17,745,000	211,000	..
Stamps	2,187,000	2,293,000	106,000	..	8,913,945	9,252,000	338,055	..
Taxes	1,270,000	1,285,000	15,000	..	3,148,000	3,208,000	60,000	..
Post-Office ..	950,000	990,000	40,000	..	3,600,000	3,800,000	200,000	..
Miscellaneous	720,928	890,166	174,238	..	2,640,484	3,201,620	561,136	..
Property Tax	2,931,000	2,132,000	..	799,000	11,104,000	9,806,000	..	1,298,000
Total Income	18,378,928	18,313,166	1,089,238	1,149,000	70,976,429	70,433,620	1,350,191	1,913,000
Deduct increase .....	..	..	..	1,088,238	Deduct increase .....	..	..	1,350,191
Decrease on the qr. ...	..	..	..	60,762	Decrease on the year	..	..	562,809

PRICES OF BUTCHER-MEAT.—PER STONE OF 14 POUNDS.

Date.	LONDON.				LIVERPOOL.				NEWCASTLE.				EDINBURGH.				GLASGOW.			
	Beef.	Mutton.	Beef.	Mutton.	Beef.	Mutton.	Beef.	Mutton.	Beef.	Mutton.	Beef.	Mutton.	Beef.	Mutton.	Beef.	Mutton.	Beef.	Mutton.	Beef.	Mutton.
1863. Dec.	8 0 - 9 0	8 6 - 9 6	7 9 - 8 9	8 0 - 9 0	7 9 - 8 9	8 0 - 9 0	7 9 - 8 9	8 0 - 9 0	8 3 - 9 3	8 6 - 9 6	8 3 - 9 3	8 6 - 9 6	8 6 - 9 6	8 6 - 9 6	8 6 - 9 6	8 6 - 9 6	8 6 - 9 6	8 6 - 9 6	8 6 - 9 6	8 6 - 9 6
1864. Jan.	8 3 - 9 3	8 6 - 9 6	8 0 - 9 0	8 3 - 9 3	8 0 - 9 0	8 3 - 9 3	8 0 - 9 0	8 3 - 9 3	8 6 - 9 6	8 6 - 9 6	8 6 - 9 6	8 6 - 9 6	8 6 - 9 6	8 6 - 9 6	8 6 - 9 6	8 6 - 9 6	8 6 - 9 6	8 6 - 9 6	8 6 - 9 6	8 6 - 9 6

PRICES OF ENGLISH AND SCOTCH WOOLS.—PER STONE OF 14 POUNDS.

ENGLISH.		s.	d.	s.	d.	SCOTCH.		s.	d.	s.	d.
Merino,	22 6 to 28 6	..	..	..	..	Leicester Hogg,	25 0 to 29 0	..	..	..	..
.. in grease,	18 0 " 24 0	..	..	..	..	.. Ewe and Hogg,	20 0 " 25 0	..	..	..	..
South-Down,	23 0 " 29 0	..	..	..	..	Cheviot, white,	20 0 " 24 0	..	..	..	..
Half-Bred,	18 0 " 23 0	..	..	..	..	.. laid, washed,	15 0 " 18 0	..	..	..	..
Leicester Hogg,	24 0 " 28 0	..	..	..	..	.. un washed,	11 0 " 15 0	..	..	..	..
.. Ewe and Hogg,	21 0 " 25 0	..	..	..	..	Moor, white,	10 0 " 13 0	..	..	..	..
Locks,	11 6 " 14 0	..	..	..	..	.. laid, washed,	9 0 " 12 0	..	..	..	..
Moor,	8 6 " 11 6	..	..	..	..	.. un washed,	7 6 " 8 6	..	..	..	..

ACCLIMATISATION SOCIETIES.*

THE geographical distribution of animal life, the means by which it is effected, the limits within which it is confined, the extent to which the different members of the animal kingdom have been or may be diffused over the globe,—these are the interesting questions which nowadays engage much of the attention of individual naturalists, as well as of those societies with whose doings, at home and abroad, we wish the public were better acquainted. As these societies also extend their inquiries to the vegetable world, and are continually making us familiar with the valuable properties of plants, and announcing the steps which are being taken for their introduction into other lands than those to which they are indigenous, they are evidently destined to play an important part in altering the physical conditions of future generations. We are confident that the men of the next century will have at their tables the flesh of beasts, birds, and fish, and also fruits and vegetables, of which we know nothing save by report. In the good times coming, through the successful labours of the Acclimatisation Society of Great Britain, Ireland, and the Colonies, we hope to dine upon Chinese lamb and Chinese yams, and to find them agreeable substitutes for British lamb and lettuce; and as such things have appeared at the first annual dinner of this Society, it does not seem too sanguine to hope that we too may partake of such delicacies as Kangaroo ham, Syrian pig, Canadian goose, guan, curassoa, pin-tail ducks, Honduras turkey, dusky ducks, and leporines.

It must be admitted that there is room for diversifying our customary fare. Without being over-addicted to creature comforts, it is allowable to experience a longing for something less common than the mutton, beef, and pork on which our cooks exert their talents. And when our posterity read of the pains we were at in enlarging the means of public alimentation, and in adorning our country with such noble trees as the Wellingtonia, the Araucaria, and the Deodara, they will not only be grateful, but be stimulated, let us hope, to imitate our example, and exert themselves in widening the sphere of human knowledge and enjoyment.

The influence of man over animated nature, his power of surrounding himself in all climates with the productions and the animals which he requires in order to fulfil his mission to possess and subdue the earth,—of all these we think too little; and, by not reflecting upon what has been already accomplished, we deprive ourselves

* 'Bulléti de la Société Impériale Zoologique d'Acclimation, 1863.'

'Third Annual Report of the Society for the Acclimatisation of Animals, Birds, Fishes, Insects, and Vegetables within the United Kingdom, 1863.'

'Acclimation et Domestication des Animaux Utiles.' Par M. Isidore Geoffroy Saint-Hilaire. Quatrième édition.

of the stimulus to hope furnished by the contemplation of the vast results already achieved. We are living upon animals and vegetable productions which in the course of ages have been acclimatised and naturalised slowly, because, in many instances, not designedly, but through the intervention of accident and foreign conquest. It is not pretended that this is the native country of wheat, oats, or barley ; of the apple, the pear, or the cherry ; of the horse, the ox, the ass, the sheep, or the goat ; of the goose, the peacock, the pheasant, the fowl. It is evident, therefore, that, by a benignant arrangement of Providence, certain species of animals and vegetables may be transported from their native seats, and be made to accompany man in his cosmopolitan migrations. If it were not so, his dominion over the earth would be inconveniently limited. If to his new country the emigrant could transport none of the domestic animals by which he was wont to relieve his labour or support his frame, and none of the vegetable productions with whose beauty and usefulness he was familiar, it is easy to understand how much his happiness would be lessened, and how seriously the progress of civilisation would be retarded. Of course there are limits to man's power over nature : all his science and care can be usefully applied only under certain conditions. A polar bear or a reindeer may be transported to the torrid zone, but they will evidently pine or speedily perish. In accommodating itself to new climatic conditions no animal is so cosmopolitan as man ; but it is as the companions of his migrations that our domestic animals are now in countries far distant from those in which they had their origin. As he has come from the east, Asia is the birthplace of by far the greater proportion of those which he has subjected to his dominion : this much is certain. If we inquire into the dates at which they were respectively domesticated, we must be contented with general statements. M. Isidore Saint-Hilaire thus sums up his learned researches :—

Among the forty-seven animals actually possessed by man, we find domesticated—

1. From the remotest antiquity, fourteen animals ; namely, eleven mammalia—the dog, the sheep, the goat, the horse, the ass, the ox, the zebu, the pig, two camels, and the cat ; two birds—the pigeon and the fowl ; and one insect—the silk-worm.

2. From Grecian antiquity, four animals : namely, three birds—the common pheasant, the peacock, and the guinea-fowl ; and one insect—the bee of southern Europe.

3. In Roman antiquity, three animals : namely, the rabbit and the ferret ; and one bird—the common duck.

4. In antiquity still, but at an undetermined period, two animals : namely, the buffalo and the common bee.

5. At an undetermined epoch, but most probably for several species corresponding to the middle ages, twelve animals : namely, five mammalia—the yak, the reindeer, the lama, the alpaca, and

the guinea-pig ; two birds—the swan and the ring turtle-dove ; two fishes—the carp and the goldfish ; and two insects—the Egyptian bee and the cochenille.

6. At an undetermined but probably modern period, five animals : namely, two mammalia—the arni and the goyal ; one bird—the Chinese goose ; and two insects—the almond and the ailanthus silk-worms.

7. In the sixteenth century, three animals, all birds—the canary, the turkey, and the Muscovy duck.

8. In the eighteenth century four animals, all birds—gold, silver, and ring pheasants, and the Canadian goose.

Such is the meagre list to which we of the nineteenth century have made no great addition, unless in the class of birds chiefly reared in zoological gardens, and of mammalia of very recent introduction, and of the importance of which we hope to convince our readers.

The human race has now existed for an unknown course of ages say some, and assuredly for about six thousand years ; but man is still very far from having subjected to his sway the hundred and forty species of animals now known to him. Of these he has domesticated forty-seven—

“And of these forty-seven species,” says M. Saint-Hilaire, “fifteen are wanting in France, thirteen in Europe. Is this a sufficient conquest of nature ? Is it enough to have in our court-yards three species so valuable as that of the *gallinaceæ*, and only one of the *rodentia*, so remarkable for its fecundity, the precocity of its development, and the excellence of its flesh. Among the large herbivorous *mammalia* is it enough to possess only four alimentary species ? In the middle of the nineteenth century, and surrounded by the marvels daily springing up in mechanics, physics, and chemistry, we have come to this—that the poor still want meat, and that the richest can only vary the meals on their table by varying the preparation of always the same meats ; among the large animals, the flesh of the ox, the sheep, and the pig, the milk of the cow, the goat, and the sheep. This is all ! With such facts, can we suppose that our civilisation is at every point advanced as far as possible ? In regard to our alimentation, can we reckon ourselves as advanced as in regard to our means of transport and correspondence ? Have we done for our health what we have done for our industry ? Singular contradiction ! which we do not observe because habit renders us familiar with it, but which will some day excite astonishment as the most inexplicable of anomalies. Almost in everything else, progress so rapid that what was yesterday now seems separated from us by ages ; and, in this fundamental matter of which we treat, progress so slow, or rather such non-progression, that in regard to the number of our butcher-meat species we are where were the Romans, the Greeks, the ancient Egyptians, and, to sum up everything, where the Chinese themselves long have been !”

Assuredly these are observations deserving serious attention. It is not easy to account for the arrest which has been so long laid on the domestication and naturalisation of animals. Bearing in mind the fact that animals of warm climates bear transportation to colder regions better than the animals of cold climates endure removal to those which are warmer, it is astonishing that nations inhabiting

the temperate quarters of the globe have had so little desire to acquire the useful animals abounding in warmer latitudes. This can hardly be owing to the difficulty of transport, and the consequent expense, which is, no doubt, considerable. Suppose that we were destitute of the horse or the ox ; it is incredible that the cost of transferring them from some distant region should deter us from attempting their naturalisation among us. We are therefore inclined to attribute the slow introduction of the different species of animals to ignorance of the fact that many of them will thrive when obliged to live on vegetable matters unlike those to which they have been accustomed. It is known that the introduction of the alpaca into Spain was retarded by the authoritative assertion that it could only live on the aromatic herbs of the Cordilleras. And with the production of the result which we deplore, the mode in which natural history has been studied has had much to do.

It was for long wholly descriptive : it stated and classified facts, but did not draw inferences from them. Under pretence of being rigorously scientific, it did not concern itself with practical utility. But now the useful application of the knowledge acquired by the labours of the traveller and the naturalist is that which causes them to be so generally appreciated. The discovery of a new production, or of a new property in some production already known, is hailed as an acquisition to the general good. When science is thus valued, its progress is assured and rapid : the speculations of philosophy become the everyday facts of common life.

The useful application of all knowledge is also immensely promoted by the gregarious tendency of our modern society. This is the age of companies, societies, committees : co-operation gives us zoological gardens, and, last of all, acclimatisation societies, whose avowed object is to disseminate the fruits of the tree of knowledge, and plant its seeds wherever there is the prospect that they shall germinate and prosper.

In this rivalry to be first in scattering the bounties of Providence, France has been, and is, conspicuous. Her naturalists have been eminently successful in popularising their science by demonstrating its public utility. Cuvier and Geoffroy Saint-Hilaire have found zealous successors in the distinguished men who conduct the Acclimatisation Society, whose yearly Report is a most valuable repository of all relating to the practical application of whatever is known in natural history. Whoever is in search of information the most recent and trustworthy regarding fish-culture, silk-culture, leech-culture, pearl-culture, the introduction of new animals and vegetable productions, and a host of matters which cannot be readily enumerated, let him consult the *Bullétin* of this Society.

As all have not leisure to peruse a bulky octavo of more than eight hundred pages, we presume many readers of this Journal will be glad to receive through us a *résumé* of what it contains regard-

ing a matter of such importance to the agriculturist as the possibility of increasing the number of useful domestic animals.

We begin with one especially suitable for the mountainous districts of this country—the yak, or ox of Thibet and Tartary, introduced into France by M. de Montigny in 1854. The little herd consisted of five males and seven females, one of the latter being a cross betwixt a common bull, or a zebu, and a yak cow. Four of them had horns differing little from our oxen, and these four were white. Of the hornless yaks, four were white and four black. They are all small, particularly the cows, which are about the size of the small Brittany breed. Their heads and limbs are stunted, and their bodies proportionally a little longer than the common cow. Their rump is round, and somewhat like that of the horse. Their tail is abundantly furnished with long hairs, but not so stiff as those of the horse. The hair of the body is generally straight or little curled, with little gloss, and long like that of the goat. The hair is in Thibet made into a thick strong cloth, admirably suited for agricultural labourers. The milk of the yak is excellent, and, according to chemical analysis, is rich in albumen and caseine. Travellers assert that its flesh is very good : of this the Parisian *savans* were speedily able to speak from experience. One of the young bulls born in France having become blind, the Council of the Acclimatisation Society resolved that it should be fattened for the table. Cooked in a variety of ways, it was pronounced excellent. Here is the report of M. Quatrefages :—“Its flesh is redder than that of the calf; its fibre is equally fine. It has a peculiar and very good flavour, something betwixt mountain veal and beef, but somewhat *sui generis*. Its juiciness is perfect. In short, we conclude that beef-steaks and fillets of yak should be superior to like parts of the ox. I do not think that the novelty of this repast has in the least increased our appreciation of it. I am satisfied that the day will come when epicures will thank the Society for having acclimatised this new ox, which I shall not the less continue to look upon as the future ox for the poor.”

Useful as an industrial and alimentary animal, the yak is not less so as an auxiliary. In steep places its sure-footedness is greater than that of any other animal. It draws, it carries burdens, and is at the same time advantageously employed as a saddle-beast. It trots rapidly enough, and its step is agreeable.

In answer to those who doubt the utility of such an animal, M. Quatrefages remarks :—“Yes, alongside of your perfect races there is as yet no place for the yak. But these races have not always existed. You have fashioned the horse, the ox, the sheep, in conformity with your wants; why may the like not be with the yak? The day is perhaps not distant when we shall have its breeds for wool, for milk, for butcher-meat. Alongside of your large farms there are many very small properties. Perhaps the yak is destined

to become the ox of the man of small capital, as the ass is already the horse of the poor. Its native rusticity, and the little food which it consumes, appear to assign this as its place. It may never inhabit the prairies of Normandy or the fields of Limagne, but on the hillocks of Vosges, on the heights of Cévennes, in the Alps, in the Pyrenees, it will browse on the short grass which pushes through the snow, as it does in its native land. Perhaps, in short, it may not be very serviceable to France; possibly it may chiefly migrate to the north. What of that? It is not the first time that France has at her own cost made experiments useful to others."

These are the very qualities which we should desire in an animal sought to be acclimatised for the special benefit of the Scottish Highlands. Our loftiest mountains will not be too inhospitable as localities for creatures indigenous to the heights of the Himalayas. Their power of adapting themselves to circumstances alien to those of their natural condition is singularly shown by their thriving in a locality so warm and low as that of Paris; so that we may expect that their introduction into this country would be a boon widely and speedily diffused. In six years the herd of twelve introduced by M. de Montigny had increased to thirty-five. They have also evinced great readiness to cross with other animals of like species. The cross between the yak bull and a French cow is a valuable animal. There can be no difficulty in introducing them into this country; and we trust that ere long we shall see the yak browsing on our hill-sides.

To France also we owe the prospect of having our domestic animals increased by the addition of a creature known from the most ancient times for its swiftness, but believed to be untamable. The Dziguetai (*Equus hemionus*), or wild ass of the Book of Job, is fairly acclimatised, and its untamability is proved to be a mistake. Sonnini, more than sixty years ago, declared "the dziguetai would be the best of ponies, if it were possible to tame it." In its native regions, Cutch, Goojerat, Tartary, Persia, and many parts of Central Asia, this animal lives in troops, under the conduct of a leader, whose alarm, on the least approach of danger, sends them bounding over hills and rocks with a fleetness exceeding that of an Arab horse. It may seem in the last degree improbable that such a creature shall ere long take its place among our light beasts of burden, and our animals for the saddle and the course; and yet, to those knowing how readily it has multiplied in France, nothing appears more likely. One of them, several years ago, had bred at Paris for the fifth time. No precautions have been taken to protect them during severe winters; and the breed, so far from degenerating, is manifestly becoming more vigorous. In this country the prejudice against eating horse-flesh is so inveterate that we fear the acclimatisation of the dziguetai will not be accelerated by the consideration that in Asia its flesh is highly prized as an article of diet.

There is another consideration weighing more with those seeking the improvement of agriculture. The cross obtained from the male of the dzigguetai and the female ass resulted, in 1844, in the production of an animal of great beauty and vigour. This crossing has been going on ever since; and the hybrids, which are strong and very swift, have in many instances been broken; and four of them, accustomed to harness either singly or together, have formed part of an agricultural exhibition, attracting almost as much notice as the finest breeds of horses.

Here, then, is a new field for our horse-breeders; they have only to cross the Channel in order to obtain a breed of animals whose utility is undoubted.

Under the general term *Lama* are comprehended at least three species of ruminants, with which Europe is destined ere long, we trust, to make acquaintance. Being mountain representatives of the camel, modified in form and habit in conformity with their position, the acquisition of them should be the especial object of those inhabiting the mountain regions of the north. Their native region is the highlands of Chili and Peru, where they abound, both wild and tame. The alpaca, the lama, and the vicugna are all of the greatest utility as beasts of burden, capable of carrying a load of about a hundred pounds, while their wool is very valuable. Their flesh, also, is as much esteemed as that of the sheep. In the introduction of these creatures Spain has taken the lead; but now experiments on a great scale have been undertaken for the introduction of the lama and the alpaca into France and Australia,—the latter country having lately held out large pecuniary inducements which have led to their being transported thither in great numbers. The difficulty of this great enterprise has been augmented very needlessly by the selfish policy of the governments of Peru and Bolivia in forbidding the export of these valuable animals. Mr Ledger, the energetic conductor into Australia of 400 lamas, alpacas, and vicuñas, spent seven years on his expedition,—two preparing for, and five in carrying it out. He led them 1500 miles through the passes of the Andes, amid which he encountered storms of wind and snow threatening destruction to the herd and its drivers. It is gratifying to learn that the colonial government of Sydney, appreciating the difficulties of the enterprise, raised the promised reward from £10,000 to £12,000, even though, of the 400 animals embarked, Mr Ledger succeeded in landing only 256 in Australia. A grant of £1500 a-year for the maintenance of the herd declared the importance attached to this addition to the industrial resources of the colony.

France has been most persevering, but most unfortunate, in her efforts to introduce the lama and the alpaca. In 1765, Buffon was thinking of enriching the French Alps and Pyrenees with the lama and its congeners. "I think," said he, "that these animals would

be a valuable acquisition for Europe, particularly for the Alps and the Pyrenees, and would be productive of more real benefits than all the gold of the New World."

The Abbé Béliardy's long residence in Spain having familiarised him with these animals, he took up the idea started by Buffon, and insisted on the utility of importing them. But science and practical knowledge could not make head against the self-conceit of some high functionary who took upon him to declare that the introduction of the lama into Spain had failed, and that it could not possibly exist without the *ycho* and the other grasses of the Andes. In vain the Abbé refuted these objections. The proposal was knocked on the head, and Buffon retired, vexed, but still persisting that it was possible to naturalise in France those species of animals so valuable to Peru.

In the beginning of this century the Empress Josephine obtained from the King of Spain a considerable herd of lamas, which, however, were detained at Buenos Ayres for six years in consequence of war; and when, at last, only nine of them arrived at Cadiz in 1808, Spain was in a ferment, and the lamas were not only neglected, but almost thrown into the sea, out of hatred to the Prince of Peace, who had favoured the undertaking.

Recent attempts have also been signally unfortunate. M. Saint-Hilaire's mission to Holland in 1849, for the purpose of purchasing thirty lamas and alpacas belonging to King William II., has had a most mortifying result.

The greater portion of them was sent to Versailles, to the care of the Agricultural Society, where they speedily perished, because, as was proved by a commission of inquiry, they were placed in a bad situation, ill cared for, and ill fed. Those, on the other hand, committed to the care of the Museum of Natural History at Paris have thriven so well that complaints are now made that the menagerie is full of lamas.

Of a hundred and twenty alpacas and lamas embarked for France by the Acclimatisation Society, only forty-five were landed at Bordeaux. Immediately on landing these were attacked by scab, for the removal of which it was unfortunately resolved that they should all be clipped. The danger of such a proceeding in November was instantly demonstrated by the destruction of the whole of them, with the exception of seven, which survived only through careful nursing.

Fortunately French naturalists are as persevering as they are intelligent and zealous, so that these disasters have only made them more resolutely bent on the accomplishment of their purpose. They rightly argue that as the lama and the alpaca have thriven in places so little above the level of the sea as Paris and the Hague, there is reason to expect a much greater success when these mountain animals are introduced to congenial localities among the Alps and the Pyrenees.

As this consideration must have great weight in determining their introduction into the Highlands of Scotland and Wales, we bring it prominently forward. These are creatures specially adapted for our Scottish hills, where, doubtless, they will know how to live; for it is a remarkable fact that they manage to thrive in regions too bare to sustain the hardy mountain-sheep.

Scotland appears already to possess lamas and alpacas; for, according to M. Saint-Hilaire, thirty-nine of these animals were landed at Glasgow in 1858 by M. Whitehead Gee, and a part of them remained in Scotland, the remainder being destined for Australia; but of this gentleman's doings we unfortunately are unable to give any account.

There being such ground for supposing that these animals could be acclimatised in this country, we have only to make up our minds as to the expediency of introducing them.

Goats are so few that the sheep may be said to be the only domesticated ruminant which browses on the herbage of our Scottish mountains. Without desiring to displace them, we are called on to decide whether they shall continue to be our only wool-producing animal which at the same time furnishes valuable butcher-meat. If we have the means of enriching our mountains with a species of animals which may be used as beasts of burden, besides supplying us with food and clothing of a kind as yet unknown to us, we shall belie our national character for shrewdness and enterprise if we do not speedily address ourselves to the by no means very difficult task of augmenting our limited stock of domesticated animals.

The inducements to engage in it are these:—Lamas, in a mountainous country, are useful as beasts of burden, being remarkably sure-footed, gentle, and easily managed. They have, it is true, the sense to lie down when overloaded; and from the camel-like structure of their stomachs, they possess the power of secreting a large quantity of saliva, which they discharge with great precision of aim on those who use them ill. These peculiarities, rendering them somewhat independent of the benevolent society for punishing cruelty to animals, are advantageous in the judgment of a humane flockmaster, who will not be displeased to know that the gentle lama is not helplessly at the mercy of a cruel and thoughtless servant. At Paris and Versailles the lama is seen trotting and galloping with a man on its back, and readily obeying the rein; and in the hilly region of Vosges it is employed in carrying tiles and manure. It eats about three times as much as a sheep. Its milk in composition is almost identical with that of the cow, but of course much less in quantity, as is the case with all animals not reared with this object in view. In butyraceous matter it is very rich, being 3.15, while that of the cow is 3.30.

It is as wool-producing animals that the lama and the alpaca merit special attention. Ten years ago the importation of lama

wool amounted to 2,200,000 lb., the prices varying from 1s. 3d. to 2s. 9d. per lb. And as by this time we are paying a very much larger sum for this kind of wool, it is time to consider why we should continue importing a production which may be abundantly furnished at home to the mutual benefit of the British manufacturer and the British agriculturist. The stuffs manufactured from this wool have been chiefly of a light texture, and are a medium betwixt the wool of the sheep and silk. They are mostly made into ladies' dresses, which are durable, remarkably pliant, and not subject to fret. But of late the application of it has been much more extensive, and it is now largely used in the manufacture of male attire, as well as for ladies' dresses.

The inevitable conclusion from all these considerations appears to be, that it is of national importance that we shall no longer be destitute of a species of animals for which this country is specially fitted, and from which we may derive at once good milk, excellent meat, magnificent wool, and very sure-footed beasts of burden. The introduction of them into Australia holds out the sure prospect of a large accession to the wealth of the colony. As we fear that Parliament will not imitate the colonial government in facilitating this by pecuniary assistance, we turn to the Highland and Agricultural Society of Scotland, and invoke its powerful aid in the promotion of an object in such harmony with the design of the institution, and so fitted to be specially a benefit to the Highlands.

Since 1854 France has succeeded in acclimatising another wool-producing animal, also to be classed among those the acquisition of which to our textile industry should be a matter of interest,—we mean the goat of Angora, in Asiatic Turkey. In its habits it has so little of the vagrant propensities of the goat tribe that it is easily managed in flocks like sheep. Its introduction into France was owing to the impression made on M. de la Sagra, commissioner of the government of France to the Great Exhibition of 1851. The beautiful tissues of Angora, especially the silk velvets, convinced him that the Angora goat ranked high among those wool or almost silk producing animals which ought to be introduced into France. Within sixteen months after the formation of the *Société d'Acclimatation*, a flock of nearly a hundred of these goats was landed in France. No time was lost in locating them amongst the Alps, the Jura, the mountains of Algeria, and more recently of Auvergne. The two places where they have best succeeded are the Alps of Dauphiné and Le Cantal. The fact of their permanent acquisition is regarded as settled. The vexing doubt arose, will the wool produced under such new circumstances preserve its silky texture? In the opinion of M. Davin, a great manufacturer and a most competent judge, the fleeces have in no degree degenerated. Of this the public had recent opportunities of judging in the Great Agricultural Exhibition in the Palace of Industry. From the flock at

Cantal were taken the fleeces from which were manufactured those light silky stuffs, and those magnificent silk velvets, which were so greatly admired.

"If so much has been done in five years, where shall we be after ten?" asks M. Saint-Hilaire. "We do not know," he replies. "At least the most difficult part is done. It is a mere question of time; and, a little sooner or later, the Angora goat will definitively take its place, in our agriculture and our textile industry, among the merinoes, which France owes to Daubenton; the yak, which has just been given to her by M. de Montigny; and the alpaca, which will come to her in its turn."

These are great achievements of acclimatisation in France. We hope that this country has entered on the same career of patient study, with the view of ascertaining how the far-spreading dominions subject to British sway may be most speedily stocked with the various animals suited to their diverse climates. No nation in the world has such an interest as we have in such experiments; and yet we may be said to be only beginning them now. Though one of the primary objects of the Zoological Society of London was the introduction of exotic animals for ornament or use, this has been so far departed from that the well-stocked garden of the Society can only be looked upon as a collection of animals brought together for the illustration of the principal forms of animal life. The utilitarian aspect of zoology as the introducer of useful species of animals is prominently presented to our notice by the British Acclimatisation Society, founded in 1861, and having, we are glad to observe, a branch society in Scotland, with its headquarters in Glasgow. We question whether any considerable number of Scottish agriculturists have ever heard of the doings of this Society, to which, however, we are already indebted for the introduction of a breed of Chinese sheep, excellent for eating, extremely prolific, and of a hardy constitution. A learned Frenchman, who has studied a Chinese Encyclopædia, reports that in China there are thirteen kinds of sheep, of which he gives the alarmingly-long names. That introduced into England is fortunately brief and pronounceable, being Ong-ti. This breed produces, it is said, twice in the year, and each time from two to four lambs. Hearing of this marvellous fecundity, giving promise of cheap mutton, the Parisian Society of Acclimatisation despatched Dr Cloquet to inquire into the fact, and if possible procure some specimens of the breed from the British Society of London. The result was curious. The young specimen which he succeeded in transporting to Paris produced only a single lamb. Supposing that this might be accidental, the Society, in concert with the Zoological Society of Acclimatisation, issued instructions for the purchase of a hundred head of that breed of sheep, whatever they call it, which the Chinese assert to produce twice a-year, and several lambs at a birth. A portion of

the animals having arrived in April 1863, the lambing of one of them took place in July. Sure enough there were four lambs apparently in all respects of the same breed, but of a different breed from the pair brought from England. Three of the lambs were healthy, but the fourth was feeble, and had to be fed by hand, as the mother refused to suckle it. To the great amazement of the Minister of Agriculture, at whose hotel the accouchement occurred, the mother had only two teats to suckle her four little ones. As there is no description of the Ong-ti sheep in the reports of the English Acclimatisation Society, we do not know whether this peculiarity has been noticed in London. As to the economy of the Ong-ti breed, M. Jacquemart notices the shortness of the wool, or rather hair, and estimates its fleece at about five shillings less than that of our sheep. Still he advises the continuation of the experiment, and holds out the prospect that both the flesh and the wool may be improved by judicious crossing. In this direction the experience of the English Society is encouraging. Twenty-five ewes of various breeds, crossed with the Chinese ram, have produced forty-six lambs. Mr Robertson reports, for Lord Powerscourt :—"The Chinese sheep still preserve their prolific character even by crossing. *They have never less than two lambs, sometimes three, and on one occasion four, at a birth.* We have now, in all, eleven lambs, the cross being very perceptible in two, more especially about the head and ears, the wool also being of so fine texture. In further experimenting we shall reverse the cross ; and if the animal still preserves its prolific disposition, I fully expect, by judicious crossing, they will ultimately prove a useful and paying breed." John J. Stone, Esq., reports :—"Eleven Southdown ewes were put with the Chinese ram. Some of the lambs are curiously coloured, and all are wonderfully healthy and thriving, promising to make large and heavy lambs as compared with the downs. I think this experiment will be one of great interest, as showing what influence the cross may have upon the fleece of the produce, that of the parents being so opposite."

The Council of the British Society submits, we think justly, that the balance of the evidence warrants the belief that in the breed of Chinese sheep a solid and valuable acquisition has been made to the resources of the kingdom. Proceeding thus, and carrying out its design "by importations calculated to increase and agreeably vary the natural products of the country," it will not be disappointed in the hope that it will "command the general respect and support of the public."

The acquisition of new and ornamental poultry and game-birds, if successfully carried out, is sure to excite public interest ; and we shall watch with solicitude for further reports on the introduction of the Honduras turkey, Chinese land-grouse, Canadian grouse, prairie grouse, American quail, &c. From Central America the Society has received a pair of the trumpeter birds. In their own

country they will trustily watch a house like a dog, and they give warning of danger by an arrangement in the windpipe which enables them to emit a trumpet-like sound. It can be trained to watch poultry, and even a flock of sheep. "These fine birds, which are expected to breed well in this country, are easily domesticated, and become attached to the human race in a most extraordinary degree." We are sorry to remark upon this statement that our English friends are probably too sanguine. The climate of Paris proves too cold for this valuable bird, and there its reproduction has never been effected.

With a zeal worthy of all commendation, the English Society is making a vigorous effort to introduce a new pond-fish—the "Murray cod," from Australia—and proposes to import for experiment the mountain mullet of Jamaica.

We suggest the acclimatisation of a delicious fish which the Australians are attempting to introduce from the Mauritius, but which we may more easily procure from Guiana, whither it was taken from the Mauritius,—we mean the counani, called in France goorami. It is from 3 to 5 feet long, and sometimes weighs above 20 lb. The description of its edible qualities is quite appetising. In Guiana it is called the sick man's fish; Cuvier pronounces it delicious, and more savoury even than turbot; and Commerson declares that he never ate a more delicious fish. After many attempts, a single specimen has been recently brought to France by M. Liénard; but as he took the precaution to leave five of his precious gooramis in Egypt in good health and safe keeping, our epicures may possibly ere long make acquaintance with this much-prized fish.

Both in England and France persevering efforts are being made to introduce the ailanthus silk-worm (*Bombyx cynthia*). Among the successful experiments is that of Lady Dorothy Neville at Dangstein, near Petersfield, Hants. Mr Buckland thus describes his visit to her plantation:—

"Her ladyship has set apart a portion of her beautiful and well-ordered garden, and has planted it with the young ailanthus trees, covering them over with a light canvass-made building—a precaution rendered necessary by the birds, who pick off the young worms. On entering this building I saw for the first time the living worms; they were in the highest state of perfection, and really beautiful things to look at; not white-faced pale-looking things, like the common silk-worm, but magnificent fellows, from 2½ to 3 inches long, of an intense emerald-green colour, with the tubercles tipped with a gorgeous marine-blue. Her ladyship pointed out to me how the silk-worms held on to the leaves; they cared nothing for rain, less for the wind. Their feet have greater adhesive powers than the suckers of the cuttle-fish, and their bodies are covered with a fine down, which turns the rain-drops, like the tiny hairs on the leaf of the cabbage. Lady Dorothy Neville explained how readily, and at what little expense, they were cultivated, and that she had found a ready market for all the cocoons she could grow—a gentleman in Paris having offered to take all she could supply for French manufactures."

Her ladyship herself gives the following report of her experiments :—

“Of the silk-worms I have nothing at present to say, as they are not yet come out; but last summer I netted over three dozen trees, and placed 500 worms on them. They yielded 480 cocoons. A bird got under the nets, and took off some before it was arrested in its mischievous career. No wind or weather seemed to hurt the worms, and we kept some of the later ones on the trees when even the leaves were frost-bitten, but the worms did not seem to suffer. I have no doubt as to their hardiness. The three dozen trees would have fed at least 2000 worms, if we had had them, as the more the worms devour the leaves the stronger the latter shoot forth.”

These facts seem to establish not only the probability of cultivating the alanthus silk-worm in this country, but the ease with which it may be carried out. The shrub itself grows hardily and abundantly in the country already, and it may be seen flourishing in several of the gardens of the metropolitan squares, notably Belgrave and St James's. It will, indeed, live anywhere, and delights in poor and sterile soil; and where it lives the worms will live also.

“The Council cannot but think that the general introduction of this new form of cultivation would be most beneficial, as it could be carried out on any even the smallest scale by every cottager or small landowner who has a garden; and a ready market may be found for the smallest parcel of cocoons. To ladies especially this operation may be recommended by the fact that they may, without the slightest hyperbole, grow their own silk dresses in their own gardens.”

These are hints worthy of the attention of many who complain that they “have nothing to do,” as well as of those who “have nothing to wear;” and for their information we add that Lady Dorothy Neville has published a pamphlet on the culture of the silk-worm, in which they will learn how to kill *ennui* and clothe themselves in silk.

We have not yet commended the doings of the acclimatisation societies to the support of British agriculturists, on the ground that they greatly concern themselves in adding to the number of vegetable substances fit for human food. The *Bulletin* of the French Society is full of interesting notices of plants and tubers, the acclimatisation of which is desirable. In the reports of the British Society we have an account of experiments on the Chinese yam, the introduction of which into France is already accomplished. All the accounts from those who have cultivated it in Guernsey are unfavourable, with the exception of that of Mr Carré, a gentleman who has paid great attention to the subject of acclimatisation. He recommends it as an article of food, and purposes extending his cultivation of it. His success leads to the conclusion that the failures in other cases are due to improper management. The roots have been tried both plain boiled and with sauce, and pronounced delicious.

In texture and flavour they are excellent, and, if one vegetable can be compared with another, may be said to resemble very good mashed potatoes. The evidence of gardeners and others acquainted with the plant leads to the belief that the Chinese yam is an excellent vegetable, and, with proper cultivation, will grow to an enormous size. It should be planted in trenches, and the lighter and the more sandy the soil, the better it will thrive.

We are agreeably surprised to learn that the Brazilian arrowroot is very successfully grown in Guernsey. The produce of this plant is sometimes enormous. "From 1½ perch," reports Mr Martin, sheriff of Guernsey, who has zealously promoted the cultivation of this valuable vegetable, "I manufactured one year 60 lb. of arrowroot, which I sold at the rate of 1s. per lb., being at the rate of £193 the acre! I have never succeeded so well since. It has never failed, however, to pay me well for the ground it occupied and the labour required by it."

In the hope of inducing graziers to patronise acclimatisation societies, we must not omit to notice that the English Society is experimenting on bunch grass, which seems likely to be of service on waste and common lands. In his 'City of the Saints,' Captain Burton gives this description of it:—"The *Festuca* is a real boon to the land, which without it could hardly be traversed by cattle. It grows in clumps upon the most unlikely ground—the thirsty sand and the stony hills; in fact, it thrives upon the poorest soil. In autumn, about September, when all other grasses turn to hay, and their nutriment is washed out by the autumnal rains, the bunch grass, after shedding its seed, begins to put forth a green shoot within an apparently withered sheath. It remains juicy and nutritious, like winter wheat in April, under snow; and, contrary to the rule of the Gramineæ, it pays the debt of nature, drying and dying about May: yet even when in its corpse-like state—a light yellow straw—it contains abundant and highly-flavoured nutriment. I brought back with me a small packet of the bunch-grass seed, in the hope that it may be acclimatised. The sandy lands about Aldershot, for instance, would be admirably fitted for its growth."

Enough has been said to demonstrate that they who expect great things from the utilitarian turn recently given to natural history are not indulging in chimerical hopes. Those of this generation have already witnessed greater accessions to the number of domesticated animals than were made for many previous centuries; and as it is by means of acclimatisation and hybridisation, or what Mr Darwin terms natural selection, that the earth has been furnished with all varieties of animals and plants, we are imitating nature when by science we bring about those modifications of animal and vegetable life which she effects slowly, because Providence wills that the greatest transmutations shall result from man's intelligent intervention. Nature does not produce the Montreuil peach, or the Fon-

tainebleau grape. Wheat is nowhere found growing wild ; and, as Buffon asks, to have modified a species of grass into wheat, is not this a kind of creation ? Nature has not given us the Durham ox, the Southdown sheep, or the English race-horse. These—and a thousand other instances might be mentioned—are examples of the manner in which man, for his convenience and comfort, modifies the handiwork of the Supreme. We are far as yet from having reached the limits of our delegated sovereignty over all the things which have been “put under our feet.” We have still much to learn as to how the earth has been peopled with all the species of animals and plants, and as to how far these may be introduced into any particular locality. We are surrounded by things acclimatised, and to the number of these, many, we are persuaded, may speedily be added by the enlightened labours of the now numerous societies whose aim is to disseminate the bounties of Providence. D. E.

THE DIETARY OF THE BRITISH LABOURER.

WHEN we turn to the Proceedings of our agricultural societies, whether these rejoice in the prefix “Royal,” or are known merely by the modest designation of a Farmers’ Club, we find that the best modes in which our domestic animals can be fed, and the varieties of food best adapted to promote the development of flesh and fat, have been frequently discussed. Chemists have found in this an ample field, and have told us all about the “why and the wherefore” of the matter ; while practical men have freely imparted the knowledge acquired by them, during years of close study in the field and fold-yard, as to the results of those systems of management which they may have adopted, and with the merits or demerits of which they have become thoroughly acquainted. Nor is the subject even yet exhausted ; and we feel that, notwithstanding all that has been said and written upon it, there yet remains in it an interesting field of inquiry, and one which will amply repay further investigation.

But while the dietary of the animals of the farm has received a due share of attention, that of the labourer who cultivates the land and takes care of those animals has been in a great measure overlooked ; and though certainly a very important matter, it has scarcely ever been touched upon at any of the meetings of our farming societies, so far at least as we can remember. This oversight, for such we consider it to be, has perhaps arisen from the circumstance that farm-labourers are supposed to be quite able to look after themselves with regard to their food, while the animals of the farm must be supplied with it, or become unprofitable to the owner. We do not

think, however, this is the right way to look at the matter; for, putting all considerations aside for the moment, except those arising from pure self-interest, as the employer is supposed to pay "a fair day's wage for a fair day's work," it must be of some importance for him to know that the food upon which his labourers live is of such a nature as to enable them to give that "fair day's work" which he is entitled to expect for his "fair day's wage." Nor is it a matter of less importance to the labourer himself—much of his personal comfort depends upon it; for this he expends the sweat of his brow, "all the labour of man," according to the Preacher, being "for the mouth"—or, as it is commonly expressed in Scotland, "to mak the pot play brown."

Those who are acquainted with the different classes of the British farm-labourer—the Scotch, English, and Irish—must be aware that considerable diversity exists in their respective dietaries; and that all, though filling the same station in life, are not accustomed to use the same kind of food. This, of course, chiefly holds good while each class remains at home; for we find that when any of them leave home, and become mixed up with labourers belonging to another part of the kingdom, they adopt altogether, or for the most part, the food commonly used by those with whom they have come in contact, at least when that food is of a more generous nature than that to which they had previously been accustomed. Thus Paddy, when fixed in England, soon gives up his once fondly-cherished "praties," and readily adopts John Bull's "frizzled" bacon, forgetful, we fear, even of Friday, when it comes round with its dietetic restraints; while the "drop of beer" is substituted for the "clane" water or the "sup" of buttermilk with which he had been in the habit of washing down his very frugal meal. It is quite natural that such should be the case; for, after all, man is a cooking animal, and is generally ready to adopt any practice which tends to develop this distinctive feature when it is in his power to do so, especially when such is agreeable to his taste.

In following up the subject which we have selected, we shall, like charity, begin at home; and certainly Scotland has no cause to be ashamed of the personal appearance of her rural labourers. Stalwart, sturdy, and intelligent fellows, they afford palpable evidence that the food on which they live is of a nature admirably adapted to promote muscular development, and sustain the body under long-continued and heavy work. That food is chiefly oatmeal—the foundation of "the kail-brose of auld Scotland," that dish upon which "Fergus, the first of our kings," is represented as regaling, after vanquishing his foes, as well as of its more refined, because more thoroughly cooked sister, "the halesome parritch, chief of Scotia's food." We are quite aware that Englishmen sneer at Sandy's oatmeal, and even potato-fed, or now maize-fed, Paddy thinks "a brose" not good enough for him; but it is just because neither John Bull nor Pat know anything

about the matter. Give John Bull a dish of "parritch," and call it pudding, and he will not only make no objection, but will find that it agrees very well with him; Pat's enfeebled stomach requires some training, however, before he can digest a full meal of brose. We may state, for the benefit of our readers out of Scotland, that brose and porridge are not identical, though composed of the same materials. The former, brose, is made simply by pouring boiling water on a quantity of oatmeal with which a little salt has been mixed, and then the mess is stirred until the water becomes mixed with the meal, rendering it thinner than dough, after which it is eaten with milk. Sometimes butter, or the fat skimmings taken from a pot in which a piece of beef is being boiled for the purpose of making Scotch broth, are mixed with the brose; but this is a somewhat luxurious mode of preparing the dish—oatmeal, boiling water, and salt being the ordinary ingredients. Porridge, on the other hand, is made by the oatmeal being thoroughly boiled and well stirred for some time, so as to present a uniform pulposus mass; and "so made," as Mr Stephens says, "with rich milk or cream, few more wholesome dishes can be partaken by any man, or upon which a harder day's work can be wrought." Quite true; though skimmed milk is most frequently used, at least by farm-labourers, simply because in their case it is often, though not always, either skimmed milk or none, and not from any lack of appreciation of the merits of cream; for it is recorded of one of that class who had rather elevated notions of what constituted the highest pitch of perfection in good living, that his most ardent wish was, he might have every day "*cream parritch and cream to them*"—that is, porridge in the composition of which cream was substituted for water, and along with which cream was taken instead of skimmed milk. Many farm-labourers in Scotland, at least those who are unmarried men, live we may say wholly on oatmeal and milk; and as brose is more readily made than porridge, all the cooking requisite being a kettleful of boiling water, it is in that form their meals are prepared three times daily. A good deal of hard exercise, and a strong digestion is required, of course, when such forms the regular article of food, and for this reason it is not a diet to be recommended for persons engaged in sedentary employments; but of exercise Scotch farm-labourers have always enough and to spare, and we have never heard that disordered digestion was a common malady among them.

But the pulposus or pudding form is not the only mode in which oatmeal is prepared for use in Scotland; it is also baked into thin cakes, and some districts are celebrated for the excellence of the oaten cakes met with in those parts of the country. In reality, there are few kinds of cakes or biscuits which can equal, much less surpass, a nicely-fired, crisp oaten cake; while it must be confessed that bread of this kind, when not baked properly, is by no means

a pleasing article of diet, unless, indeed, in cases where a sharp appetite renders one oblivious, for the time being, to the mere gratification of taste. Although, no doubt, a good deal of the difference which exists in oatmeal cakes is owing to the amount of skill employed in the preparation of them—much good food being spoiled by bad cooking—yet it is true that the meal produced from oats which have been grown on different kinds of soil will not produce the same quality of bread; oats which have been grown on sharp land producing, according to Mr Stephens, the kind of meal best suited for cakes, while oats grown on heavy soils yield the best meal for porridge. This mention of Mr Stephens reminds us of what a reviewer of 'The Book of the Farm' in 'Blackwood's Magazine' said several years ago regarding the nourishing qualities of an oatmeal diet; and we are sure our readers will allow that the following quotation from that review is very appropriate to the point under consideration:—

"What makes our racehorses the best in the world may be expected to make our peasantry the best too. We offer you, therefore, a fair bet:—you shall take ten English ploughmen, and feed them with two pounds and a half of wheaten flour a-day, and we shall take as many Scotch ploughmen, and feed them on the same weight of oatmeal a-day—if *they can eat so much*, for that is doubtful—and we shall back our men against yours, for any sum you like. They shall walk, run, work, or fight you, if you like it, and they shall thrash you to your heart's content. We should like to convince you that Scotch parritch has some real solid metal in it. We back the oatcake and the porridge against all the wheaten messes in the world. We defy your home-made bread, your household bread, your baker's bread, your leaven bread, and your bread-Georges; your fancy bread, and your raisin bread; your baps, rolls, scones, muffins, crumpets, and cookies; your bricks and biscuits, balls and rusks; your Bath-buns and your Sally-buns; your tea-cakes, and pancakes, and soda-cakes, and slim-cakes, and saffron-cakes; your plumcakes, and currant-cakes, and spongecakes, and seedcakes, and girdle-cakes, and singing-hinnies; your shortbread and currant-buns; and if there be any other names by which you designate your wheaten abominations, we defy and detest them all. We swear by the oatcake and the porridge, the substantial bannock and the brose."

Let us see what grounds the writer whose words we have quoted had for asserting that his ten oatmeal-fed Scotch ploughmen could "walk, run, work, or fight" any ten English ploughmen fed on wheaten bread. The reason is simply that oatmeal contains a much larger proportion than wheaten flour of the material of which muscle is formed. That material is gluten, a substance identical with muscle, and therefore adapted for the purpose of sustaining muscular development under circumstances where a rapid waste of muscle takes place. Scotch oatmeal contains 18 per cent of gluten, while fine wheaten flour, of English growth, is stated by Johnston to contain only 10 per cent of that essential constituent in the food of the hard-working farm-labourer. Hence the reviewer in 'Blackwood' was perfectly justified in his estimate of the sustaining powers of an

oatmeal diet; for his ten model Sandies absorbed daily, in their brose or porridge, nearly twice the amount of muscle-producing matter that their English opponents would do—fully bearing out the old proverb which tells us that

“Barley bread will do you good,
Rye bread will do you no harm,
Wheaten bread will sweeten your blood,
But oaten bread will strengthen your arm.”

But the elementary matter of which muscle is formed is not the only substance in which oatmeal excels flour, the proportion of oil or fat it exhibits on analysis being 4 per cent greater than the proportion contained in English flour. In starch, it is indeed comparatively deficient, but this is made up by the excess of oil; and even the starchy matter of oats is converted into a special article of food in Scotland, though it is only in the family of the married labourer, whose better-half can attend to such matters, that we meet with “sowens;” and even among married labourers this article has become much more rare than it once was, owing to improvements in mill machinery, by means of which the meal is more completely separated from the husk than it was at one time, leaving but poor “seeds” for the manufacture of “sowens,” unless helped by the addition of a few handfuls of the meal itself. To our perhaps depraved taste there are few more pleasant suppers than a dish of sowens and new milk; and our opinion of its value would, on one occasion at least, have been backed by a certain burly English M.P., who happened to lose his way in the Highlands, and after wandering for hours, reached a shepherd’s hut thoroughly exhausted from hunger and fatigue. The poor woman had not much food of any kind in the house, but to what she had she made the worn-out legislator welcome; and, as he afterwards described the proceeding, “she took some dirty water out of a tub and put it into a pot, and, by the blessing of God, it came out a pudding.”

The fact that Scotch farm-labourers receive a stated quantity of oatmeal—generally 65 stone each per annum—as part of their wages, has no doubt tended to render it the standard article of food among the peasantry, both for old and young, and it is usually considered to possess virtues which are of too subtle a nature to be detected even by the chemical analyst.

“Gie a wean his parritch,
And dinna spare the sour-douk can,”

says Ballantine in one of his songs; and there are some who aver that the metaphysical tendencies of the Scottish mind, and the superiority which so many of Scotia’s sons have exhibited in some of the more abstruse walks of science and literature, as well as the national sturdiness of disposition, all originate in the national por-

ridge. "We cultivate literature on a little oatmeal," was the free rendering of the motto which Sydney Smith proposed to his collaborators as the most appropriate they could select for their conjoint labours when they first appeared in the character of Edinburgh Reviewers; a motto too truthful, perhaps, to be pleasant, but which might have been taken in its integrity by many whose names have found a lasting place in science and literature. That food does exercise an influence on the intellect has been demonstrated by physiologists; and the idea, therefore, that the material which has formed, during successive generations, the standard food of the Scottish people has had a certain effect on the national character, cannot be considered far-fetched. Were it for no other reason we should regret the increasing consumption of wheaten bread, made of foreign flour, which is observable of late years in most of our rural towns and villages; but we also know that food of that kind is less suited to repair the waste of muscle resulting from hard work, and on every account we too "swear," with the reviewer in 'Maga,' "by the oatcake and the porridge, the substantial bannock and the brose."

Previous to the introduction of turnip husbandry into Scotland, which occurred about a hundred years ago, pease were much more extensively grown than they are at present, and this was the case, in fact, until artificial manures enabled farmers to extend their turnip-break, the produce being used chiefly as food by farm-servants and country workmen of all descriptions. In 1857 there were only 3687½ acres under pease entered in Mr Hall Maxwell's returns, the counties in which this crop was most extensively grown being Aberdeen, Berwick, Fife, Perth, Ross and Cromarty, and Roxburgh. This shows that pease are now much less used by the peasantry, although in some parts pease are still given as a portion of the wages in kind of farm-servants, along with oatmeal. Pease-meal, especially when mixed with a small proportion of barley-meal or flour, makes excellent "bannocks;" and pease in themselves are certainly a very nutritious kind of food, the proportion of gluten they contain amounting to 22 or 23 per cent,—an enormous difference when compared with the 10 per cent of muscle-forming material contained in English flour. Bean-meal makes bitter bread, which is not the case when pease-meal is used; and we think the Yorkshire combination of "beans and bacon" infinitely preferable to beans alone, or even in conjunction with flour, as material for the manufacture of bread. The fine pea-flour, universally known as "Glasgow brose-meal," is made, we believe, from white pease imported from Canada. This is comparatively a modern article; and it is not only relished in Scotland, but we observe that the use of it is extending in other parts of the kingdom, where, however, it is chiefly employed as a ready material for making soup. It is an excellent and most nutritious article of diet, and deserves

the consideration of all who are desirous of improving the food of the labouring classes in those parts of the kingdom where the usual scale of dietary is low and insufficient to sustain men engaged in laborious employment. The price, indeed, at which it is sold is rather high compared with other articles, but a small quantity serves the purpose, and it is very useful as affording a good variety in the ordinary bill of fare.

The Scotch rural labourer does not use much animal food ; indeed we may consider him as practically a vegetarian, and therefore a good argument, taking his robust appearance into account, for those who contend that a vegetarian diet is better adapted to sustain the body in a healthy state than one of which animal food forms a prominent part. The married labourer who lives in a village, or in a cottage detached from the farm on which he is employed, has usually, though not always, his pig ; and, in most cases, the entire carcass of that profitable animal is reserved for the use of the owner and his family. This, undoubtedly, is a great addition to the cottage commissariat, and is duly appreciated as such ; still we scarcely think that pig-keeping is as extensively practised in Scotland as it ought to be ; at least we know that in several parts of North Britain there is not that anxiety evinced by cottagers to have a pig, and to keep it well, which we find evinced by people of the same class in England. There the pig is a decided favourite ; it is, in fact, a species of savings bank, in which the prudent cottager invests his spare shillings by the purchase of food for the use of that animal in whose progress towards maturity he takes a great and laudable interest. The John Bull cottager does not conceal the pride he feels in his pig ; but Sandy, being more of a stoic perhaps, is less demonstrative, and to some extent more careless, about his "soo," although by no means insensible to the allurements of a piece of fat pork for dinner.

There is one kind of food peculiar to Scotland—a standard dish among the middle classes—and he is indeed a poor man, even as a cottager, who cannot afford to have it tolerably often for dinner,—we mean Scotch broth, which, when well cooked, is, in our humble opinion, not only one of the most agreeable, but also one of the most nutritious articles which can be produced in any country. There is not a doubt, we think, that broth, as made in Scotland, was originally introduced through the close connection which existed for such a lengthened period between Scotland and France ; or, as certain French culinary preparations bear a strong resemblance to it, perhaps the French derived their ideas of the matter from the Scotch. Let it come from whence it may, Scotch broth is a first-rate article, and as different as chalk is from cheese from the mess of bread-crusts and beef-boilings which goes under the name of broth in England. We are not aware that Scotch broth, properly so called, and cooked as a thoroughbred Scotchwoman only can cook it, has ever been

subjected to examination by any chemist, for even our own Johnston seems to have overlooked it. But if such were done, we venture to say that the nutritive qualities of the article would astonish those who have not experimented upon it practically. A good "pat-fu' o' kail" is, in fact, a model article of the kind—a duly proportioned mixture of flesh-forming as well as fat-producing materials. That such should be the case is evident from the composition of Scotch broth—a combination, namely, of meat, vegetables, barley, and pulse. Nor is it requisite that the meat used in making broth shall be the best pieces in the carcass, as inferior parts are much better adapted for this purpose than those which are usually set apart for roasting, and therefore sold at higher rates. This is one great recommendation of Scotch broth to all who wish to have as large an amount of nourishing food as possible at the lowest comparative cost. We need scarcely urge the valuable properties of prepared barley or pease; and these are also found to exist to a large amount in the cabbages, greens, onions, leeks, turnips, and carrots, which usually form a considerable proportion of the materials of which Scotch broth is composed. Even the plainer forms of the article, where chopped cabbages or other plants of that tribe, boiled in water and thickened with a little oatmeal or barley, to which a bit of dripping, butter, or lard is added, along, of course, with a sufficient quantity of salt, is by no means to be despised, although, from its nature, it might form a suitable dish in Lent.

Potatoes form a considerable item in the dietary of Scotch married labourers and their families, and it is the custom in several parts of the country to give farm-servants a certain number of yards in length of ground to be planted with potatoes as part of their wages, in the same manner as they get a stated allowance of oatmeal and milk. But although this is the case, and although cottagers generally can have potato-ground on some neighbouring farm, yet they do not rely upon that root as their sole food. The universal use of oatmeal has prevented this from being the case; and it is well for the Scotch cottager that it is so, for potatoes, however good as an auxiliary, form but a poor staff to lean upon. Potatoes, however, are not invariably used in their natural state, but are often converted into a very palatable soup, with the aid of a bit of dripping or lard, and flavoured with onions and parsley; or they are transformed into the still more palatable form of "chappie," by which name mashed potatoes are known and appreciated in many a humble rural home in Scotland. And when salt, pepper, a bit of butter, and an onion finely shred, with a little sweet milk, are all mashed up and thoroughly incorporated with the potatoes, and the "chappie" thus prepared eaten warm along with sweet milk, it does not require any power of reasoning to show that it is both a palatable and a nourishing description of food.

Of the "great chieftain of the pudding race," the haggis, though a frugal and eminently a national dish, we fear we need scarcely make mention when treating of the common articles of diet used by the peasantry of Scotland; at least we know that it is rarely seen in many parts with which we are acquainted unless on some public festive occasions, when such a national dish as the haggis could not be well omitted. We should regret much, however, were the haggis to degenerate into merely a show dish. It deserves a better fate, and most heartily do we join with Burns in his remonstrance on this subject:—

"Ye Powers wha mak mankind your care,
And dish them out their bill o' fare,
Auld Scotland wants nae skinking ware
That jaups in luggies:
But, if ye wish her gratefu' prayer,
Gie her a Haggis."

In compassion for the ignorance of those, even amongst ourselves—to their shame be it said—who are unacquainted with the mode in which a haggis is prepared, we shall give the details as followed for years by "our ain gudewife." Take a sheep's paunch, and clean it properly, observing not to enlarge the hole any more than is absolutely necessary, as it must afterwards be sewed up. Let the pluck, the heart, liver, and lights be parboiled for an hour, then grate the liver, and chop up the heart, and about half of the lights, as fine as possible. Have a teacupful of oatmeal toasted nicely before the fire until it becomes browned, then mix this thoroughly in a basin with the prepared pluck, a little finely-shred suet, and sufficient seasoning of shred onion, salt, and pepper. Take some of the stock or water in which the pluck was boiled, and pour it among the other ingredients until the whole is brought to the consistency of thin porridge, then turn all into the paunch, sew up the opening firmly, tie it in a towel or clean cloth, and boil *gently* for four hours. During the process of boiling, probe the haggis occasionally with a "darning-needle," to allow the air to escape. Some add eggs, and other spices than merely pepper and salt, but the foregoing is the genuine article. Great caution must be used when the haggis is dished and about to be served out, so as not to make too large an opening at first, because if this is not attended to, there will be an inundation of haggis all over the table. It has been our fortune to introduce the haggis into some parts of the kingdom where even its name was previously unknown, and we have been often amused to see how those who, at first sight, could scarcely be persuaded that out of such apparently unpromising materials a palatable dish could be constructed, were gradually led on to taste, impelled perhaps at first by curiosity, and partly by the grateful odours emitted from its dewy pores. To taste was to eat, and

"Then horn for horn they stretch and strive,
Deil tak the hindmost! on they drive,
Till a' their weel-swalled kytes belyve
Are bent like drums."

Unbelievers in a haggis, only try it! And if it ever be your good fortune to taste a well-prepared lamb's haggis, you will renounce French "kickshaws" for ever.

Cheese, which is regarded in many parts of England as an indispensable article of food, is more an appendage than a leading feature in the dietary of the Scotch labourer. It is true that skim-milk cheese is much used in some districts, along with bread and milk; but that kind, though rich in muscle-forming material, is so poor in fatty matter as to be nearly as tasteless, and certainly as indigestible, as a cork, so that we can quite coincide with the sentiment a Scotch ploughman emphatically expressed as he spread some butter on a slice of poor cheese—"The deil be in their fingers that sundered ye!"

Taking the ordinary dietary of the Scotch labourer as a whole, there is evidently no lack of substantialness in the materials of which it consists, although there is certainly a want of variety, especially where the bothy system prevails; in which case brose and milk three times daily, all the year round, is usually the fare. So accustomed, however, are those who live in this manner to the sameness of their food, that were any one to hint at the propriety of having greater variety, the proposition would no doubt be received with considerable astonishment, and the herd-boy's interrogatory, "Div ye think every day is New-y'r-day?" would most likely be put to the dietetic reformer. In the cottages of married men, when the wife is a good manager, as most of the wives are, the case is usually different, and there is by no means this invariable sameness in the daily bill of fare. A great amount of comfort will often be found in those humble cottages; and on high occasions, "the gudewife" will put "a tea" on her table such as will not be readily met with in houses of much greater pretensions. You will have two or three kinds of bread, and as many varieties of preserves, a cheese, and fresh butter such as town-dwellers know little of, all seasoned by a homely but hearty welcome, which shows, that although your entertainer has done her best for your comfort and gratification, and has a reasonable pride in the result of her labours, she does not begrudge you her good things. We know too well that more attention requires to be paid to many points connected with the condition of the Scottish rural labourer, particularly in the matter of house accommodation; but in so far at least as his food is concerned, he has usually plenty, though some may consider it as rather coarse in its nature; but if so, it is well adapted to sustain his body under the hard labour he is called upon to undergo in the performance of his duties.

When we cross the borders we find very little difference in the dietary common in Northumberland, &c., from that which prevails in the south of Scotland. Payment of wages in kind is equally a feature in Northumbrian as in Scotch farms; and this, of course, gives a character to the description of food generally used. But when we travel further south we perceive a decided change in the mode of living, and we also learn that, except in some particulars, the dietary of the English rural labourer does not present the same distinctive character that the dietary of his northern compeers possesses. There is a sort of idea generally prevalent in other parts of the kingdom that the English labourer is an unusually highly-fed animal, and that, from morning to night, his chief occupation consists in stuffing himself with beef or bacon, bread, beer, and pudding. We daresay there are plenty of the class who would desire nothing better than such an existence; but although the dietary of the English labourer is often of a most substantial nature, it is not so in all cases. He consumes much more butcher-meat than the Scotch labourer—it is, in fact, an essential part of his diet. His wife, too, can usually turn little odds and ends to account, in the shape of meat or fruit pies, better than the Scotch “gudewife,” chiefly from having the advantage of a more elaborate cooking apparatus; and all these little odds and ends, at which, perhaps, a Scotch ploughman—theoretically, at least—would turn up his nose, come in very handily to fill up gaps in the weekly supply. In other respects there is, however, frequently a good deal of waste in the manner in which the Englishwoman cooks her “bit of meat;” and a Scotchwoman, with her “kail-pot,” would make the same “bit” go further for the good of a family. As we have already remarked, English labourers generally manage to have a pig; and it is always an evidence of some screw being loose if any part of that pig is disposed of otherwise than as food for his owner and his owner’s family.

It may be that some of the notions which exist regarding the English labourer’s consumption of food may have arisen from people having occasionally seen him going to work and carrying his food along with him. They have seen the ploughman going a-field with his team, and his “tommy-bag” suspended on the haims of one of his horses, while he carried his little keg of beer in his hand; and they have judged from this that he could scarcely allow an hour to pass without food of some sort or other. We have, indeed, seen men walking along by the side of their wheel-ploughs busy stuffing themselves with a portion of what they had brought with them; but the contents of the bag—a hunch of bread and a bit of cheese or cold meat—with those of the beer-keg, are usually discussed while the horses get their mid-day bait; for in many parts of England, the plough-horses are not put to work until eight o’clock in the morning, and go till four in the afternoon,

when their work is done for the day—with the exception of half an hour's rest at mid-day by the side of a hedge, when the nose-bags are affixed to the horses' heads, and their drivers set to with knife in hand to their share of creature comforts. It is but a comfortless meal after all, both for men and horses; and while the former are less benefited than they would be with something warm, the latter, from their hastily bolted and undigested bait, not unfrequently get the colic.

That the English agricultural labourer is accustomed in several parts to a low scale of diet is shown in a paper read a short time ago by the Rev. J. Slatter of Streatley, Berks, before the Ashmolean Society, Oxford. That gentleman confined himself chiefly to the condition of things in his own parish, which he believed to be not an unfair specimen of the general state of the case in that part of England. From Mr Slatter's statement we learn that wheaten bread constitutes the bulk of the food consumed by the agricultural labouring population of his parish; and while some thrifty housekeepers buy the flour and make their own bread, this article of food is generally bought ready-made. In this respect the parishioners of Streatley differ materially from others of the same class met with elsewhere in England; as in the latter case every cottage has its brick oven, which is made use of generally once a-week, for the purpose of baking all the bread required in the family until the next baking-day arrives. It is a fact that such bread actually becomes sweeter towards the end of the week than it is at first; and in those parts of England it is considered the height of wastefulness to buy bread at a baker's shop. Mr Slatter regrets that the habits of his people are opposed to oatmeal, seeing that it is so much more substantial an article of food than wheat-flour; and in this regret, it is almost needless to say, we cordially agree.

With flesh the labouring population of Streatley seem to be little acquainted, and Mr Slatter informs us that "in the form of fresh meat it may be wholly excluded from notice. It is never tasted," he says, "except as a charitable gift at Christmas or some festival, or during sickness." The only form in which meat is consumed is in the shape of bacon, and even this the labourers of Streatley do not derive from their own sties, being in the habit of purchasing "English or Irish bacon, which is 8d. per lb., and American, which is 4d. or 5d." The amount consumed, therefore, in each family is extremely various, depending entirely on the income. "The main staple is bread, and the diet is enriched by as much bacon as can be afforded in addition." This is but a sorry state of matters; and it is evident that, were the people of Streatley encouraged to keep pigs for their own especial behoof, it would add greatly to their comfort. Even "cheese is sparingly used," and milk—skimmed milk—can only be obtained in very small quantities for the purpose of being added to the tea which the men mostly take with every meal.

Neither do potatoes and vegetables form any regular part of the diet of the Streatley people, being "taken in such varying quantities that it is hardly possible to estimate what effect they have in contributing to the available amount of nutriment. When they are to be had, they appear to be used to the saving of bread." With respect to beverages commonly used by the Berkshire labourers, "coffee," we are told, "is comparatively little used. Tea is very general. Beer can hardly be called a part of the labourer's dietary; they can rarely or never afford to drink it. Some make a very wholesome small-beer for drinking in harvest-time; but, for the most part, it is only consumed under circumstances that are injurious alike to health and morals; and it need not be said that when two or three shillings go on the Saturday and Sunday in this way at the public-house, in almost every case the wife and children suffer correspondingly in their allowance of food."

Mr Slatter sums up the mode of living common among the labourers of his parish in the following manner:—"A piece of bacon (when the allowance is small, the whole) is cooked for Sunday's dinner. While it is hot, all dine off it with what vegetables they can get, generally about 7 lb. weight of potatoes. The children have upon their bread a tiny portion—generally, not always, about say $\frac{1}{2}$ oz. at the outside. The rest is put by to be eked out cold for the man's dinner in the field as long as it will last. All the rest of the week the children, and generally the women, have no more animal food, except by accident. I ascertained from a little girl about nine or ten years old that she had four slices of bread per day. I weighed the quantity indicated by her, and found that her allowance would be about 12 oz., perhaps 14 oz. The butter is in such small quantity that it is hardly to be rated as more than a condiment." The reverend gentlemen from whose paper we have been quoting, suggests improved dwellings as a means whereby the condition of the agricultural labourer would be ameliorated; but if such dwellings are not accompanied with better food, and more of it, we fear that even a better dwelling would do very little towards improving the condition of its occupants. With better dwellings we would suggest allotment-gardens, to be cropped with a variety of vegetables; and, along with this, that each cottager should have one of that thrifty breed of swine which takes its name from the shire in which Streatley is situated. The pig would supply, in the first place, manure for the garden; and, in the next, a cheaper and better description of meat than that which is at present within the reach of Berkshire labourers, and which, with the beans, cabbages, potatoes, &c. &c., raised on the allotment-ground, would make a very material improvement in the dietary of the poorly-fed labourer, and his still more poorly-fed family.

But if beer "can hardly be called a part of the labourer's dietary," so far as Berkshire is concerned, this is not the case in other parts

of England ; and, indeed, the use of beer is so prevalent among English labourers that we almost consider the case of those of Berkshire to be exceptional. A daily allowance of beer is given to each man, just in the same way as the Scotch farm-servant gets his daily ration of sweet or skim milk, and a feeling generally obtains among employers that labourers cannot do a proper amount of work without beer. Thus, Mr Fisher Hobbs said, in a paper which he read in 1851 before the Central Farmers' Club, "I am decidedly of opinion myself, and I believe the majority of practical farmers will agree with me, that the labourer derives unquestionable benefit from a daily allowance of home-brewed beer, and that the man who can do the best day's work is the one accustomed to the use of it." And again, "Beer I advocate as the right and support of the hard-working man." We are not going to argue the question from a teetotal point of view, but we do think that such statements as the above involve a considerable amount of fallacy ; and, in order to prove that such is the case, we need only point to the Scotch farm-labourer, who is a milk and not a beer drinker, to satisfy any one "that the man who can do the best day's work" is not "the one accustomed to the use of beer." It is true that in some parts of Scotland a comparatively trifling allowance of small-beer is served out to farm-labourers during harvest, but that is considered more as a refreshing beverage than as the medium of conveying an extra amount of nutritive material into the body of the labourer. If the beer allowed to the English labourer was of a wholesome, light, pleasant nature, like Prestonpans beer, and looked upon merely as a beverage assisting the mastication of his dry bread-and-cheese, without placing any stress on its nutritive properties, real or supposed, there would be less to say against its use ; but we are convinced that the regular use of beer, such beer as English labourers drink, is to render them a set of dull, heavy-headed animals, neither so intelligent nor yet such continuously hard workers as the Scotch.

That the amount of nutritive matter contained in ordinary beer is small is evident, when we consider that "good Edinburgh ale" only "contains about 4 per cent, or nearly half a pound to ten gallons, of malt extract or solid matter, which consists of undecomposed sugar, of soluble gluten from the grain, of bitter substances derived from the hop, and of a certain proportion of mineral matter" (Johnston). All this "malt extract" cannot, therefore, be strictly considered as nutritive matter ; and if "good Edinburgh ale" only contains about 4 per cent of such extract, then the proportion existing in the beer of the English labourer, even although such may be home-brewed, must be much less, probably not much more than 1, or at most 2, per cent. Compare this with new milk, which contains, according to some of Voelcker's recent analyses, from 12½ to 14½ per cent of butter (pure fat), casein (or flesh-forming matter), milk-sugar, and mineral matters or ash. Looking at it, there-

fore, as a nourishing article of diet, beer, even the best, cannot be compared with new milk ; and we say most decidedly that it would be better for all parties, English employers as well as English labourers, were the popular fallacy which prevails in that part of the kingdom, regarding the nutritive qualities of beer, to become exploded, and the Scotch system of using milk to be followed. It would be cheaper for employers, and better for the men.

Although there exists a general belief in England "that the man who can do the best day's work is the one accustomed to the use of beer," there are many English employers who do not share in this opinion, and who have practically proved its unsoundness. The experience of those parties have been published from time to time ; but we shall confine ourselves to one instance, chiefly because we have the pleasure of being personally acquainted with the gentleman, and are aware that he has persevered for years in carrying out a system, with respect to his farm-labourers, quite opposed to that which prevails in the district in which he lives, as well as in other parts of England, and that his system is at the same time liked by those who are in his employment.

Mr Henry J. Wilson farms one thousand acres of light land, on the four-course shift, at Newlands, near Mansfield, Notts. The land was originally part of Sherwood Forest, and has been mostly all reclaimed by Mr Wilson and his father within the last twelve or fourteen years. In a paper on the subject under consideration, Mr Wilson says—

"It is usual to furnish malt liquor to the men at hay and corn harvest, to meet, as is supposed, the need for extra exertion at those seasons. This frequently consists of a definite quantity (about five pints) of ale, and an indefinite quantity of small-beer—the daily value being from 1s. to 1s. 4d. per day. If 5s. a-day be a fair average of the daily wages, then we find the hard-worked harvestman receiving one-fifth of his pay in drink ; drink, too, which actually prevents his doing as much work as he otherwise would do. The question will here naturally arise, 'What is the best substitute?' 'Water, pure water,' will be the answer of those who never did a hard day's work in harvest, under a burning sun when not a breath of wind is stirring, but they will not be supported by many who have had that experience. . . . In my own experience, tea and coffee have been found most acceptable to the men. The proportions have been 1 ounce of tea and 7 ounces of sugar to a gallon of water, the cost amounting to about 5d. a gallon. Each man will consume about one gallon a-day ; the saving will therefore be about 9d. a-day, or, say, 21s. for the whole of harvest ; and if each man earns, as I believe he can, 6d. a-day extra by his abstinence, he will find himself with 35s. more in his pocket at the end of harvest than if he had continued to drink ale."

After showing that the principal difficulty in the way of such an innovation as this on the long-established custom of the country, lies in "the anticipated opposition of the labourers"—which opposition, however, is generally less formidable than it appears at a distance, and may be easily overcome by a little common sense on the

part of the employer—Mr Wilson proceeds to state his own experience, and the manner in which he carries out his system. He says—

“As far as my own experience goes, there have been none of these difficulties with the men. They entered on their first teetotal harvest with strongly-expressed doubts as to the result, but after a few days frankly admitted they were never better in their lives. Since then we have gone on steadily for eight years (1862), with no difficulty in procuring plenty of help, even in harvests when labour has been scarce. I have never had a man, not even a stranger, turn his back on an offer of work on account of the drink. The same gangs from a distance will return year after year in the hope of getting employment.

“In our neighbourhood, the cutting of hay and the cutting and tying of corn are always done by piece-work, but securing the crop is paid for by the day. The wages paid to our men by the acre are the same as those paid by our neighbours, with the money value of the customary drink in addition. They are then supplied with tea or coffee in any quantity they choose, for which they pay about 1½d. a gallon under cost price—that is, 5d. for coffee, and 4d. for tea. The advantage of this is, that it prevents all waste; and, moreover, as most men are content with from three quarts to a gallon a-day, it would not be fair that they should be averaged with those—and there are such—who can consume double the quantity. When working by the day, each man receives three or four quarts of tea or coffee, and the difference in value between this and the customary drink is added to his wages.”

The process by which the daily demand, which varies from twenty or thirty gallons a-day, up to fifty and even seventy gallons, is supplied, is as follows:—

“The apparatus is simple: a copper holding twenty-four or twenty-five gallons, a fine wire sieve, and three or four tin or earthen vessels of from three to five gallons each. Suppose twelve gallons of tea is wanted for breakfast at eight o'clock, in three or four different fields at some distance from the homestead: about seven o'clock twelve quarts of boiling water must be poured over twelve ounces of tea, and allowed to stand for half an hour, then strained through the wire sieve, and nine gallons more water added; at the same time five and a quarter pounds of sugar and two pints of milk are added, and, after thorough stirring, it is ready for delivery, which is accomplished by a donkey having a couple of large vessels slung across his back, or by a couple of lads. It is accompanied by a pint measure to deal it out, and a tun-dish or funnel to pour into bottles provided by the men. If coffee be desired we use four times as much ground coffee, and twice as much milk, to the same water and sugar.

“All this, although it seems easy enough, will require the personal attention of the master or mistress at the commencement to insure the satisfaction of the men; and nothing will so soon produce disgust and discontent as delay and irregularity in the supply. As to the results, I have already said that the master ought not to enjoy the direct pecuniary benefit; he will have sufficient reward in securing the advantage to his men, and the order and propriety which will prevail on the farm: quarrels and bad language will be greatly lessened or entirely cease; accidents will be fewer; the men will be far more regular in their attendance, and the work will be done when he wants it, and more in accordance with his orders, while he has the satisfaction of knowing that he is doing something towards saving his fellow-creatures from the multifarious evils resulting from habits of

drinking. The men will find they can do their work more easily; they will enjoy better sleep at night, with greater vigour in the morning; they will have a better appetite for their food, and more money in their pocket—to say nothing of the moral and even religious results which usually follow.”

When Mr Wilson says “the men will” do so and so, he is in fact telling those employers who have not tried his system, the results he has actually experienced; and, considering the length of time during which he has carried out that system, it must be allowed by all that his experience is most valuable, and the opinions he has expressed, based upon it, not easily set aside. It is undeniable that the use of beer in the field induces the men to visit the beer-shop in the evening, for even the liberal and often enormous amount of beer they imbibe during the day fails to slake their thirst, and often increases thirst, owing to the quantity of salt which is frequently put into beer, and thus the beer-shop system, which has been denounced times without number, is perpetuated. As we have already said, the Scotch farm-labourer is a convincing proof that beer is by no means a necessary, much less an essential, article in the dietary of the rural classes; and the experience of Mr Wilson and others shows conclusively that even English labourers are led with very little trouble to see that the use of it is a positive loss, both physically and pecuniarily, instead of being a gain.

As to the cider, which is substituted for beer in some of the south-western shires, it is a still greater sham than small-beer as a nourishing article of diet. Even the best cider contains little solid matter, but it has fully as much alcohol as the strongest ales. Weak cider, such as farm-labourers receive, partially stimulates the system, and is certainly a refreshing drink on a warm day; but so also is vinegar and water, and much of the small cider is little better.

We now come to the last part of our investigations into the prevailing dietary of the rural labourers of the British Islands, and in it we find the lowest scale of any to which we have as yet alluded. It is long since poor Paddy was described as the worst lodged, the worst clothed, and the worst fed of any; and though some changes have unquestionably taken place of late years in his condition, the description is still, unfortunately, but too true. It would almost appear as if Paddy had been subjected to a series of experiments in order to test how little food, and that of the least nourishing kind, it was possible for a man to live upon; and certainly, were it not for the extraordinary vitality of Irishmen, which has enabled them to keep alive under circumstances where others would have sunk, the race must have become extinct long ago. But only give Pat an occasional bellyful, and he is all right. He goes on his way rejoicing, energetically fulfilling his allotted task of multiplying and replenishing the earth.

For many years the potato was the Irish labourer's only food, and with him at that time,

"The finest diversion under the sun,
Was to sit by the fire till the praties were done."

To obtain a supply of this food, if he was not a "farmer," he rented annually a con-acre lot, for which he paid an enormous rent, far beyond the intrinsic value of the land. With regard to the quantity of potatoes which formed the daily consumption of a working man, we find the following statement in an article on 'The Potato Failure, and its Effects on Irish Agriculture,' contributed by Mr Fitzherbert Filgate, in 1848, to the 'Agricultural and Industrial Journal,' a publication which was issued at that time in connection with the 'Transactions of the Royal Agricultural Improvement Society of Ireland':—

"Having at one time taken some pains to ascertain what might be fairly considered as the average weight of potatoes consumed daily by an able-bodied working man, I found the answer varied from 10 to 21 lb. of good picked potatoes. The question was asked of men who had been eating, indeed almost living upon, potatoes all their lives, and yet no two of them gave the same answer. It was perfectly evident they had never thought of asking such a question, or troubled themselves to try. They could talk of *pots* of potatoes—so many pots were boiled—but they could form no idea as to how much the pots contained. The potful of potatoes was boiled, the potatoes turned into a basket, round which the family sat, and what remained was never wasted, because it went to the pigs, or the poultry, who often were not content to wait until their proper time arrived, but used to come in, like pert and forward children, before they were sent for.

"It may be assumed that 14 lb. is a fair average of a working man's daily consumption of potatoes. If this quantity appears large, it must be remembered that in 14 lb. of potatoes there are about 10½ lb. of water. Threepence per stone would not be too high an average price for potatoes picked as described. So here we have the daily food of the working man costing him threepence; and supposing the family to consist of five, allowing 10½ lb. for his wife, and 7 lb. for each of their children, we have a daily consumption of 45 lb. of potatoes, worth, at the price named, 9½d."

In Ulster the mixed Scotch and English origin of the people shows itself not less in their ordinary dietary than in their habits, their temperament, and their very language, for in many parts of the northern province the "braid Scots" prevails in all its purity, even to the retention of words which have almost become obsolete in Scotland. Though "brose" is unknown, oatmeal, in the form of porridge and cakes, is, and has always been, a leading feature in the dietary of the people of Ulster. "Kail" is also a well-known article of food, though it is usually more literally "kail" than in Scotland—that is, cabbages or greens are used in larger proportion. Still it is "the kail," imported originally, no doubt, by the remnants of the broken Border clans, who formed a considerable proportion of King James's early colonists when he "planted" Ulster. In Sir Charles Coote's 'Survey of Armagh,' published sixty years ago, we find it stated that "The food of the lower rank is potatoes, stirabout [porridge], oaten bread, garden vegetables, bacon in sum-

mer, and beef in winter. There is no part of Ireland," he says, "where the peasantry consume so much flesh-meat;" a striking contrast to the state of matters described by Mr Filgate.

A great deal of information on this subject may be obtained in the Reports of the Irish Poor-Law Inspectors, who had been directed to inquire into the nature of the dietary used by "the lowest class of peasantry" in their respective districts; and we shall, therefore, proceed to epitomise some of that information.

Mr Robinson, inspector of the north-eastern portion of Ulster, reports that "the diet of the labouring classes in agricultural districts consists principally of oatmeal or Indian-meal porridge, and potatoes and buttermilk;" that "in some cases the heads of the family have tea and flour or oatmeal cake for breakfast; and that, whenever such is the case, a portion is given to the children;" that "occasionally a piece of bacon is obtained for Sunday's dinner, and sometimes herrings or eggs are substituted for the usual dietary;" and, finally, that "the provisions he saw in the different houses appeared of good quality, and tolerably well cooked," both very important points. In Magherafelt Union, in the county Derry, it is stated "the greater part of the labouring classes get stirabout for breakfast, dinner, and supper. Some get potatoes and milk for dinner, and stirabout for the other two meals." In Cavan, however, matters are less satisfactory, inasmuch as "the poor labouring classes in the winter season can only procure potatoes and milk. It may be the father gets occasionally a little calf's flesh"—that is, the flesh of a newly-dropped calf, or what is commonly called "stagging bob;" "but his children have to live on potatoes and bread three times a-day. In summer time it is better, as he can earn more; they generally have water-stirabout and milk for breakfast; potatoes and herrings, or eggs, or it may be calf's flesh occasionally for dinner; and potatoes and milk, or water-stirabout, for supper, as they can procure it."

From the north-west of Ulster Mr Hamilton reports, that "in the county of Londonderry, and in the neighbourhood of towns, the lower classes use a more varied and better description of food than in other parts of the district;" that "the food of the people of Donegal seems to be inferior, both as regards quantity and quality;" that "a man in full employment, with a wife and five children over seven years of age, appears to purchase about 40 lb. of meal, 7 stones of potatoes, and 30 quarts of buttermilk" weekly; an allowance which is trenched upon, so far as the family requirements are concerned, by the circumstance "that dogs and poultry (generally a good many), and very often a young pig, are fed in the house." That more or less tea is used in almost all the families is evident from the fact, reported by Mr Hamilton, that a small shopkeeper in a remote village in the county Donegal sold £30 worth of tea on an average every week.

Mr Bourke states that in Connaught "the food of the lowest class of married labourers, having families, is the same in town and country, and consists of potatoes. Buttermilk is used during the season when it is abundant; but, for the greater portion of the year, the sole accompaniment of the potato is a salt herring or other dried fish. Such," he says, "is the constant food throughout the year of every member, young or old, of the family of the labouring man, with a wife and three or four children, whose subsistence is derived from his daily wages alone. When potatoes are dear, he substitutes Indian meal." Mr Bourke also states, "that almost all labourers rent land for a potato crop, which, being tilled after working hours, or by the females and children of the family, affords the staple article of food at less than market price. It also enables them to keep a pig, fed upon the small or bad potatoes, and sold at a profit," not eaten,* "when the crop is exhausted." In the case of a superior class of labourers, "the diet is varied by the introduction of eggs, and the use of sweet milk for the younger children. Cabbages likewise are grown, and eaten boiled with oatmeal and a little salt." It is only the most comfortable class of labourers who indulge in tea, and "never more frequently than once a-week. Meat is scarcely ever consumed by the labourer's family except upon rare occasions, such as Christmas and Easter, or during summer, when new-born calves are brought into market and sold cheap."

From the south-west of Ireland, Mr Lucas reports that "potatoes and sour milk, taken together, form a very considerable portion of the diet of the peasantry; in fact, it is their general food, and is only varied by the accidents of the season; and when potatoes are scarce and dear, then coarse bread, and stirabout made of Indian meal, are substituted." In his 'Returns,' Mr Lucas states that "Indian-meal stirabout and sour milk (sometimes new milk, but that very seldom) are used for breakfast; potatoes and sour milk are at other times used for breakfast; potatoes and sour milk for dinner; also brown bread made from third or fourth quality flour, with sour milk, sometimes used for dinner. When potatoes can be obtained at near the cost of bread, preference is given to that article of diet—they consider them more 'plentiful;' besides, they can be eaten with less milk than bread." Again, "sometimes the husband, when at hard work, obtains a pennyworth of bread for supper, of which the youngest child receives a slice."

From Mr Hamilton's 'Returns' we learn that, in the county Waterford, a family of five or six persons, of which three or four are under fifteen years of age, generally use 3 stone of Indian meal and 7 gallons of sour milk weekly, and that "when the head of the family is at work he gets about one shilling's worth of bread and

* Paddy rarely eats his pig; it "*pays the rent*," and, as Goldsmith says, his owner "would as soon think of eating the pan it is fried in."

sixpence worth of milk weekly, in addition to the Indian meal, &c." A labourer in county Kilkenny, whose family consisted of himself and wife and four children, used weekly 4 stones of Indian meal, $1\frac{1}{2}$ stones flour, 3 stones potatoes, 50 quarts skim milk. "This man," says Mr Hamilton, "keeps a pig and hens, his wife sells apples, &c., in the season, pays no rent, has a brother-in-law in America who sometimes sends a little help. I only saw one bed in his house, and the pig was in the corner. His wife stated to me that she varies the food as much as their means will admit, as the Indian meal 'causes worms.' She states the bread is for her husband, as he must work hard. The pig shares in the quantity of food stated in the annexed column." Another family in county Tipperary, consisting of the same number of persons, used weekly 4 stones Indian meal and 22 quarts sour milk. The "Indian meal is made into stirabout, about 1 lb. meal to half a gallon of water, and boiled about two hours." This man pays one shilling a-week for rent. When questioned as to how he procured clothes for his family, he said they cost him little, as they were all nearly naked. There are many days that he cannot get work. His wife earns a little by pulling heath and selling it in the town."

Mr Horseley's report from the counties of Cork, Kerry, and Limerick, states that "the articles of food used almost exclusively are potatoes, Indian meal, household or fourths wheaten bread, oaten-meal, sour or 'thick' milk, and buttermilk. The Indian and oaten-meal are used in the shape of griddle bread and stirabout. The household flour is used only in the shape of bread baked on the griddle or in a pot oven. Meat is scarcely ever tasted except on Christmas-day and Easter-day; and even on these occasions a large proportion are only able to procure a little salt or a little fresh fish to make a feast. Occasionally, in the spring months, the labourer in the neighbourhood of a dairy farm may procure a quarter of veal—that is, of a calf one or two days old; but this is a rare occurrence. As a rule, no skimmed or new milk is used except in cases of sickness, or when there may be delicate children in the family. In some districts, however, many families possess a goat or two, which graze on commons or the roadside, and thus a little milk is obtained for the aged and the young children. In winter and spring months, when sour and butter milk is scarce, a little sugar is used with the stirabout; and when it can be afforded, a small quantity of red herrings or dried mackerel is used as 'kitchen' with the potatoes, but this is seldom the case. When Indian meal is exclusively used, the quantity per day consumed by a man is 3 lb., by a woman 2 lb., and by children under fifteen years of age, $1\frac{1}{2}$ lb. on an average. When potatoes are exclusively used, the quantity per day for a man is $10\frac{1}{2}$ lb., for a woman 7 lb., and for children under fifteen years of age, from 5 lb. to 6 lb."

It is scarcely necessary to say that such a dietary as that which

is given in several of the examples we have quoted from the 'Returns' of the Irish Poor-Law Inspectors, is quite insufficient to maintain a man so as to render him capable of sustaining a continuance of hard labour. Indian meal is an improvement on the potato, inasmuch as it contains six times the quantity of flesh-forming matter which exists in the potato; but, as the reporters state, it is only used as food when potatoes are scarce and dear, because a great prejudice exists against it in the minds of the Irish peasantry, who cannot be persuaded that "yellow meal," as they call it, possesses any useful qualities. With a scale of wages which seldom exceeds 1s. a-day on an average, it is hard to suggest any radical improvement in the dietary of the Irish labourer, but still we think it is not altogether impossible. One mode by which this might be effected is, the introduction of a greater variety of vegetables into the list of those which an Irish labourer usually cultivates whenever he has a bit of ground. In most cases his sole crop is the potato, while in others cabbages are grown to a certain extent. Now, cabbages form not only an agreeable but also a very nutritious variety in the diet; being, with respect to the amount of gluten or flesh-forming matter which it contains, according to Johnston, "more nutritious than any other vegetable food which is consumed to a large extent by men and animals." The union of cabbage with potatoes, and the addition of a little pork fat, salt, and pepper, constitutes col-cannon, a dish which Johnston says, "has all the good qualities of the best Scotch oatmeal, and to many would be more savoury and palatable." The regular use of col-cannon would render those who adopted it "stronger and more active;" and we cannot see any reason why it might not form a regular part of the dietary of the Irish labourer, who appears, however, to look upon it as a sort of make-shift, whereby he is enabled to eke out his supply of potatoes, rather than as a nourishing and agreeable description of food. Beans, pease, carrots, parsnips, turnips, onions, &c., ought also to be grown on the labourer's allotment or in his "garden;" and, in fact, his employers, for their own sakes, ought to insist that he shall grow those vegetables in due proportion when he gets possession of his patch of ground. We happen to know some proprietors who have laid down such rules with respect to the management of allotments, and with the most satisfactory results, when they have taken care to see that the rules laid down are carried out; for Paddy, if left to himself, will have all his land cropped with "spuds," as he calls potatoes, and nothing else.

To talk of soup in any shape to the Irish peasant, as a palatable, cheap, and nutritious article of food, is to run the risk of having your head broken. Soup and Protestantism are so closely allied in Paddy's mind, that even to whisper the name of "soup" is to make him suspect that you are bent on his conversion, and one of the most opprobrious epithets in his vocabulary is employed when he calls a man "a souper." This is unfortunate, for soup is all we

have said it is, and could be easily added as a feature in the dietary of the Irish peasant. His circumstances, even in his own land, are undergoing a change; and it will be all the better for him and those who employ him, if his dietary is rendered as much like that of the Scotch labourer as possible.

We are quite aware that we have by no means exhausted the subject which we have been discussing in these remarks. It affords not only ample scope for investigation, but also for the exercise of efforts designed to effect improvement; and when we say this, we say it with reference to the labouring classes in all parts of the kingdom. There is often a good deal of waste of material in the manner in which food is prepared for use, and there is also frequently a want of variety which could be easily remedied if people only knew how to avoid waste and produce variety. Might not plain cooking be added as a branch of education in country schools, and in town schools frequented by tradesmen's children? They are already taught how to make a shirt, why not teach them how to make a potful of good Scotch broth, a digestible dumpling, a savoury haggis, or a nutritious dish of col-cannon? If covering the back is so important a matter that the elementary steps are looked upon as an essential part of a girl's education, why should the best modes of satisfying the ever-recurring wants of the stomach in a grateful manner and at a moderate cost, be thought less essential? We certainly consider cooking-schools quite as necessary as sewing-schools; and were a university for females established, we would assuredly elevate "Mrs Margaret Dodds of the Cleikum Inn" to the dignity of "Principal."

SALMON LITERATURE.*

"OF making many books there is no end." This was one of the things done under the sun which afflicted the soul of Solomon. But in this grief Mr Russel does not appear to share: not only is his book on the salmon the most recent concerning that valuable fish, —he is at pains to record the names of the worthies, ancient and modern, who have dabbled in fish lore; or, better still, been lovers of the gentle art. In fact, according to him, to be an angler is enough to give a man an *a priori* title to be considered a gentle and a generous man. Byron and Dr Johnson, having spoken disrespectfully of angling, are "questionable persons." There is no evidence that Shakespeare was in the habit of taking a day's sport on the Avon or anywhere else; but, lest this should seem disparaging to the immortal bard, we are assured that information is amissing regarding many other things besides this that the bard *must* have done. "What other sport is consecrated by having been the subject of so much poetry, and the delight of so many poets? Angling alone is ancient and poetical, has been practised, and its praises sung in all countries and generations." And yet "the nonsense about the salmon that has been published under the name of natural history, and thrust down the throats of parliamentary committees, is, when looked back upon, appalling in amount, variety, and worthlessness."

To the truth of this we heartily assent, and we are glad to be able to add that, in the dissemination of reliable information, and in readiness to give a fair hearing to all having anything to say about salmon, the able editor of the 'Scotsman' has been honourably distinguished. And now that his various papers have assumed the form of a book, we have much pleasure in commending it as pleasantly and vigorously written, and conveying much valuable knowledge upon a matter of great interest and importance.

Mr Russel is so well acquainted with what he writes about, that we hesitate to dissent from his statement that the secret of packing salmon in ice "was discovered by a Scotch laird, called Dempster of Dunnichen." We have been accustomed to hear this important change in the mode of transmitting fish ascribed to Mr Richardson of Pitfour, grandfather, we believe, of the present Sir John Stewart Richardson.

In the chapter on the natural history of the salmon we have a careful discussion of these four questions: Is the parr the young of the salmon in earliest infancy? At what age does the smolt emigrate to salt water? After what length of absence does the emigrant return to fresh water? In what shape does he return, "grilse" or salmon?

* 'The Salmon.' By Alex. Russel. Edinburgh: Edmonston and Douglas, 1864.

The novel heresy of Mr Mackenzie of Dundonnell, that the grilse is not the young salmon, but a different species of fish, is controverted with much humour, and an imposing array of facts ; it being admitted that it has been too much the custom to take it for granted that grilse and salmon are only names of one fish at different ages. "There is a story of a Scotch minister, on a catechising raid, after having got the people's answer to the question, 'Who made you?' proceeding most unfairly to the further question, 'How do you know?' Jock grew red in the face, scratched his head, and then, rising by an instinctive leap to the height of the argument, replied, 'It's the common clash o' the kintra.'"

While admitting, in certain matters, the value of the argument founded on common assent, Mr Russel is of opinion that where facts are attainable they should be relied on to the exclusion of the "common clash." Foremost amongst the proofs that the grilse is an adolescent salmon, is placed the fact that "salmon ascend rivers more or less in every month of the year, whilst grilse do not ascend at all until a certain period, and then, so to speak, come all at once; from which two facts, we submit, it is a fair inference that the one is an adult fish, capable of ascending at any time, and that the other is a young fish which just attains to the capacity of ascending at that season at which its ascent is found practically to begin. Or put it thus—the difference in the time of ascent points to the inference that salmon are the produce of several years, and grilse of only one year." That the grilse is the young salmon on its first ascent from the ocean, is corroborated by the fact, that the shoals of smolt descending have been demonstrated, in many instances, to begin their return to the river in about seven weeks as grilse. If these grilse, weighing from three to four pounds, be not young salmon, when and where are young salmon of these weights to be seen? "These youthful salmon do undoubtedly exist. Mr Mackenzie, if he hold to his theory, cannot tell us where they are. We point to the grilse, and say, *there* they are."

Mr Russel gives a sketch of the legislation which at various periods has regulated salmon fisheries, and does justice to the present Lord Advocate's unhappily vain efforts for the removal of fixed engines in the form especially of stake-nets. As the removal of these obnoxious nets is the most important thing yet to be done for the improvement of the salmon fisheries of Scotland, and as those interested in them have been able to retain them in opposition to Government and to the interests of the public, we quite agree with Mr Russel that it is necessary to inquire more particularly what these engines are, and why they are, whence they came, where they are going to, what they have done, and what ought to be done to them. His chapter on these points is admirable. He grapples with the "cant" that stake-net fisheries are "property," and that to take it away without compensation is injustice ; and the argument for right of

continuance, derived from forty years' prescription, is, in a question of legislation for the common weal, denounced as "nonsense."

"Forty years" is the present cry of the owners of sea-shore fixtures; but the owners of river and estuary fisheries, when it was long ago and often proposed to do to them what is now proposed to the coast-fishers, might have cried "ten times forty years," and could have pointed to charters and laws expressly giving them what the law afterwards took away from them; while the owners of sea-shore fisheries cannot show any charter in which their engines are authorised or mentioned, or any law in which they are mentioned except to be prohibited. Even as matter of fact, the statement that these nets have existed on the sea-shore for more than forty years is not true, except to a very limited extent; it is only two or three of the earliest of them that can boast that degree of antiquity. "The year 1821 was the date when the first stake-net was erected on the shore of the sea. The place was Dunninald in Forfarshire; and the man who did the deed is still alive and (strange to say) happy."

"But though the facts as to the real age of the engines now in dispute were otherwise, it would be monstrous to infer that what has existed for forty years has thereby acquired a right to exist throughout all ages, especially when it is plain that the whole scope and principle of the fishery laws, extending over centuries, has been to restrain or suppress whatever was found to be inequitable or injurious, without regard to the date or circumstances of its introduction. 'Prescription,' therefore, must go out of the controversy as an impostor and interloper."

Equally decided opinions are expressed as to the necessity of the Legislature preventing the pollution and poisoning of running waters. The English Fisheries Act imposes penalties upon "every person who causes or knowingly permits to be put into any waters containing salmon, or into any tributaries thereof, any liquid or solid matter, to such an extent as to cause the waters to poison or kill fish," unless he can prove that he has "used the best practicable means, within a reasonable cost," to render the matter harmless. In an article on the Salmon Rivers of England and Wales, we pointed out the murderous effects upon fish of matters flowing from mines and manufactories, and brought forward the singular fact that certain noxious stuff does not destroy life, but communicates to the salmon so vile a flavour as to render it uneatable. The Legislature should bear this in mind, otherwise a salmon fishery may be rendered worthless without any legal remedy, seeing that the existing law only forbids nuisances which poison or kill fish.

Mr Russel will not listen to those who insist that nature intended rivers to become sewers for the removal of all fecal matter; and he has no faith in the recently propounded dictum of Professor Bennett, that stinks are innocuous. Speaking of the Tweed, he indignantly asks, "Shall the turrets of Abbotsford be reflected from a

monster gutter all stains and stench? Shall fair Melrose, instead of being 'viewed aright by the pale moonlight,' be nosed in the dark? Forbid it, all the powers of Parliament! If, indeed, that prohibition could not be uttered without destroying or impeding the brisk and cheerful industry which has sprung up among those sweet hills, there might be nothing for it but to sigh and submit. But it would be almost profane to doubt that from so great an evil there must be no means of escape—that Hawick may prosper, and yet Tweed be preserved. The manufacturers in great towns have already been made to consume their smoke, and the time seems coming when compulsion to the same effect will be applied even to London householders, when even the 'sacred domestic hearth' shall be invaded by the officers of sanitaryism. The Londoners have agreed to impose upon themselves a vast expense, in order to cease making a sewer of their own Thames; and can it be doubted that if the people of the towns on the Tweed and other such rivers shall fail to find the *will*, there will be comparatively little difficulty in the Legislature finding the *way*, to prevent their doing what they unhappily like with a river which is not their own, but is the property of five counties, and the pride of two kingdoms?"

Our space only permits us to add, that we fervently hope the vigorous author may long continue to wage war with stake-nets, stinks, and salmon-slaying selfishness in all its forms!

CONTINENTAL RAMBLES BY ROAD AND RIVER.

No. I.

THERE are two sayings or aphorisms which the traveller abroad should always bear in mind,—one of them given utterance to by the greatest thinker amongst Continental writers; the other by one of ourselves of high reputation as a brilliant essayist. These aphorisms are—"There are things which you do not notice only because you do not look at them;" and, "We never can see the country if we do not turn aside from the road." Bearing these in mind, and acting upon them, it will be difficult for any traveller in Continental regions to return home without a note-book, or, what is better, a retentive and trustworthy memory, filled to the full with matter at once interesting and instructive. Of course the following out the admirable advice conveyed by these aphorisms is totally inconsistent with the rapid railway express-speed mode of travelling which is the characteristic feature of the English tourist abroad. This

kind of travelling, doubtless, takes one across the country rapidly enough, but it puts aside all hopes of one seeing anything of it. Time, therefore, is essential to the tourist really desirous to note the character of the country through which he passes, and to become acquainted with the habits of its people. Nor must he be deterred from examination by the unpromising appearance of things by which he may be surrounded, for it is not only true that beneath the surface of things rude may lie a soul of beauty, but the feature of a landscape, the position of a house, or the habit of a peasant, all unpromising in exterior as they may be, may, on examination, give a clue to something which may possibly have puzzled the traveller aforesaid, or make him acquainted with a process of high value in agricultural economy, or interesting in commercial or social polity. To aid this end and aim of useful travelling, we would counsel the tourist to eschew the company of commissionaires and guides—asses they are, plodding the same dull weary round from day to day, much more frequently harassing one with a wearisome repetition of stale stories or tiresome traditions, than by drawing attention to things worth knowing, or by pointing out beauties really worth examining. Further, be strong-minded enough not to be led in the leading-strings of hotel-keepers and the like, who, if you consult them as to routes or what is to be seen, will give you little else than a route which must be rapidly travelled over, and a dry list of hotels at which you must stay. For it is a thing worthy “to make a note of,” that while Continental waiters upon English pleasure-seekers have in themselves a wholesome dread of quick travelling, still they seem to be so impressed with the notion that an Englishman is always in a hurry, and by the demon of *ennui* goaded on to further and quicker flights, that he invariably counsels, as if it were the kindest and the best, travelling in the quickest of flying posts and the fastest of railway expresses. The result of the whole of which style of doing things is the traveller’s return home with a nightmare sort of feeling—a pressure on his memory of bowing hosts, cringing commissionaires, chattering cabmen, visions of boats flying past beauties which only tantalise him, and trains dashing past towns and villages only too attractive for all that he has seen of them. This may be travelling through a country, but it is not seeing it. And if the tourist desires to return home with a knowledge of something else than all this—which, parenthetically, we call the nightmare of travelling—he must bear in mind the counsel given in the aphorisms with which we have commenced our paper; ever remembering that before he can see a thing he must look at it, and that before he can see a thing to look at, he must leave the beaten track and go into the by-ways of travel. Drawing to recollection the vast pleasure as well as useful instruction we have received from going off the beaten paths of tourists, and tracking out new roads for rambles, it seems to us a strange thing to know of men

who, with no excuse to offer, as lack of time or lack of money, rush rapidly along by railway or boat, seeing nothing and recalling nothing. Take, for instance, the usual way of seeing that king of rivers, the Rhine; the traveller has the choice of the boats and of two railways at least—two from Coblenz, where the finest of the Rhine scenery begins. By taking the boats he certainly can see both sides of the river as he ascends or descends it, and on both sides many beauties are to be seen all the way from Coblenz to Bingen. This affords, on the whole, a fair notion of the river scenery, and is infinitely preferable to the system adopted by go-ahead men who take the railway. Knowing what we do of the Rhine beauties, we can have no terms sufficiently strong to characterise the stupidity of the railway mode of rushing along the Rhine; for, independently of the fact that sitting in a close carriage prevents you having a look up from the base to the top of the banks, all fresh and gorgeous in their beauty, and striking with their ruin-capped rocks, *only one side* of the river can be seen, for the railways on both sides of the river skirt the base of the banks all along, so that by far the most suggestive of the views are utterly lost. By simply traversing the length of the river by boat or rail thus, one is said, in tourist slang, to “have done the Rhine;” but if anything is “done,” to quote from another style of slang, it is the traveller himself; for beautiful as that river is,

“Whose breast of water broadly swells
Between the banks which bear the vine,
And hills all rich with blossomed trees,
And fields which promise corn and wine,
And scattered cities crowning these,”

no one, nevertheless, has any claim to say that he has *seen* the richest of its scenery and the most suggestive and striking of its many quaint towns and villages, who has not stopped at various places and hunted up the otherwise hidden beauties of the valleys which branch off on either side. It is altogether useless for us to pretend to convey to the reader any adequate notion of the beauties of these valleys. These are perfectly unique, and, having travelled not a little in both the Old World and the New, we can truly say that we have never met with a class of scenery so bewitching in character; so much so that the chief objection we have had to them—not being at the various times we have sauntered along the Rhine in the best of walking trim—has been that they have perpetually tempted us to continue our stroll along them, each turn promising new beauties, so that in the eagerness to see we have forgot the feebleness of our frame. The way in which the lateral valleys intersect themselves, is not their least interesting feature. You enter one of these valleys either direct from the road which skirts the banks of the river, or are led to it through the

narrow streets of a town bordered on either side by the quaintest of houses, enriched often by the finest and most picturesque of architecture, with the impression that it will continue its primary direction at right angles to the river till it leads you to the interior of the country; but you are doomed to be disappointed, and disappointed too in one of the pleasantest, as it is certainly one of the most interestingly beautiful of ways. You may not for many minutes have walked—or rather strolled, so often are your steps arrested by some lovely combination of rock and rivulet; for almost every one of these valleys embraces in its bosom the most sparkling of streams, leafy tree and flowery bank—till you are surprised by another valley branching off from the right or the left, sometimes from both; and then again by other banks, till, on ascending a higher point of view, you see the country spread out before you broken up by a singular series of valleys, so that it has the appearance of a gigantic sea, its waves of rocks thrown up in the wildest confusion, covered with the greenest of verdure and sparkling with the sweetest of wild-flowers. Sometimes these valleys will all open into flat holms or haughs, the encircling sides of which, covered with trees, come close down to the edge, and in the centre of which a sparkling stream meanders. These flat spaces, very small in extent of surface, are the only places where grass may be grown for the purpose of being cut either for green forage or for hay. The most is made of these beautiful spots, for the waters of the little streamlet are almost invariably led to various parts of their surface by a simple mode of irrigation. By wandering up and down these valleys, some very curious details as to the agricultural economy of the peasants inhabiting them may be obtained. A very short sojourn at one of the quaint villages of the Rhine will satisfy the traveller as to the abundance of milk and butter, at least for the supply of the table of the hotels; and yet in his wanderings in their neighbourhood, or up the valleys to which they open, he will very rarely indeed, in the spring and summer seasons even, see cows grazing. In autumn, when the fields are cropped, he may meet with a few tethered so as to eat off the stubble, but generally the traveller sees cows only used as beasts of draught. Cattle are all stall-fed; and, from the small supply of grass or hay, which we have already mentioned, there is every means taken to supplement this. In walking along the road or up the valleys, you will meet frequently women, rarely men, carrying huge bags of cut wayside vegetables, which they are carrying home to the stall-fed "Crummie." We have frequently seen this forage cut up by means of a very primitive hay or chaff cutter, and it appeared to us that it was little more than dandelion. The profusion of dandelion in many of the meadows is one of the features of German agriculture. In the district in which we now write—the centre of the duchy of Nassau—the meadows in the flat spots between the valleys are yellow with the flowers, or white with the downy seeds, of this plant. It is not considered so much of

a weed as with us, as tending to increase the flow of milk, and to make the milk and butter bitter. Our readers are of course aware that a species of dandelion is largely and exclusively cultivated on the Continent as a forage plant. Along with this a small quantity of mangold-wurzel is generally given, and a mouthful of hay most sparingly dispensed. Grass of a better quality is, of course, used in the summer weather. This style of living, together with the continual confinement of the animal, while producing butter sweet enough in taste, although, as above said, it turns bitter, gives it that white, sickly, curd-like appearance, which all observant travellers on the Rhine know to be its characteristic; the fine, rich-coloured butter produced from milk yielded by cows fed in delicious spring pastures is rarely met with. The beautiful valleys we have thus been alluding to are generally met with in the most romantic part of the Rhine, between Bonn and Bingen, and abound also in the upper or hill districts of the duchy of Nassau, near Schlangenbad or Schwalbach—the latter one of the sweetest spots one would care to sojourn at. In the districts bordering the Rhine between Coblenz and Bingen, grass crops, as we have above said, and indeed the cereal crops, are scanty; the bedding of the cattle is composed, therefore, principally of leaves. The leaves of the poplar are the most generally esteemed for this purpose, and the trees are trimmed so that the shoots spring out from the lower parts, where they are easily reached. For cattle, the tender shoots with their leaves on are generally thrown down to make bedding; in other cases the leaves are stripped off or gathered from the ground. It seems to be the duty of the women to go up the valleys and gather these leafy shoots; for you can take no saunter up them without meeting one or more who are coming down with huge burdens, which they carry on their heads in an easy, dexterous way. The manure yielded by this bedding, enriched by the droppings, liquid and solid, of the animals, is carefully preserved; and, being generally stored up in the immediate neighbourhood of the houses and in a freely exposed style, as if the collection was a thing to be proud of and examined every day with satisfaction, it so happens that in passing the houses of the German peasants, the air is felt to be filled with something more pungent than pleasant, and which renders not the less acceptable the smell from the flower-covered banks or the blossom-bearing branches which greet you if you extend your walk beyond the houses. In a country where manure is so valuable and so highly prized, one would suppose that the streets—or rather, as we would call them, lanes, so narrow are they—would be carefully swept, and all refuse calculated to add to the richness of the dung-heap or the manure-tank heedfully stored up. But in walking along them the eye is often offended and the sense of smell assailed by villanous-looking collections of liquid filth, proceeding from the cow-houses or the butchers' slaughter-house. So much is this the

case, that a writer has remarked that you can scarcely walk along the streets of a Rhine town with dry shoes. It will be long, we fear, before the improved modes of sewerage, so generally introduced nowadays in our country, will be adopted in the numerous small towns of Germany. Our readers will doubtless remember the pungent verse of Coleridge provoked by the pungent smells of Cologne, famous for its "seventy-two separate and well-defined stinks"—

"Ye nymphs who reign o'er sewers and sinks,
The river Rhine, it is well known,
Doth wash your city of Cologne;
But tell me, nymphs, what power divine
Will henceforth wash the river Rhine?"

From which it is to be presumed that the final place of the town sewage—to use the modern and fashionable name for this substance—is the noble river itself; so that if the contamination is repeated at every town and village on its banks, we may conceive the condition of its waters to be far removed from the degree of purity its friends boast of. But it is here to be noted that the fault—the sanitary fault—to be found with the small towns on the Rhine is, not that the liquid filth we have named as so often met with in their streets is led to the river, but that it is retained in the streets, making pools and rivulets of its own. Almost every small town has been in early times, for obvious reasons, built on the banks of the small stream or rivulets which flow down from the valleys—the tortuous line of which the houses follow, giving that peculiarly straggling and quaint expression to the streets with which every saunterer in the Rhenish towns is so well acquainted. It would therefore be supposed that the small stream—being, as an Irishman would say, "mighty convanient" for the purpose—would be gladly availed of for the purpose of carrying from the streets the filth which too often accumulates there. But the cleanliness and purity of the stream is most scrupulously attended to; in fact, it has been sarcastically observed that it is the only thing which is kept clean in some of the Rhenish towns. The dung collected from the litter, &c., of the stall-fed cows is taken to the fields and the roadsides in long, narrow, clumsy-looking, but in reality lightly-constructed carts, drawn almost invariably by oxen. Rude as the vehicles of some parts of Germany are, we may remark, in passing, that our mechanics might with advantage take a lesson from them. German farmers have no notion of dragging dead weights about. Nor are milk-cows exempted from the draught service; we have seen young heifers and cows, within a very short period of their calving, dragging heavy loads slowly along the road with that patient gentleness so characteristic of the bovine race. The distribution of the manure to the tiny fields which lie in the holms or stud the sides of the lateral valleys of the Rhine, to which we have already alluded, is no easy matter; and, in the case of the vineyards, many

of which literally hang on the precipitous banks, the labour involved is of the most arduous kind. All has to be borne on the back; and it is painful to see men and women toiling up the sides of what are, in many cases, precipices, and under a burning sun. But what will men not do when compelled by the stern necessity of living? And all praise is due to the dwellers on the Rhine banks for the patient industry with which they beat out a living from their not always kindly soil. And the hard labour necessitated in the field is, moreover, painfully supplemented by the long distances to which the peasants have to walk to and from their houses. With the exception of the few houses or mills which are met with up the valleys, and which are of course isolated and near the tiny fields their inhabitants cultivate, the houses are all congregated together, forming little towns or villages. Hence arises one of the most remarkable features of a large portion of Germany—the absence of farmhouses and cottages; these, with the exceptions above noted, are never met with, and the result is, that the fields which the workers cultivate are often very long distances from the houses in which they live. When one recalls to mind the interminable wars which have almost literally flooded the fields of Germany with human blood, we can easily understand why the people of these troubled districts crowded together to secure that protection which numbers might now and then, but isolated dwellers apart never, hope for. From this circumstance of town or village living arise some of the peculiar features of German life, of which it is not our present purpose to take any note here, but which, nevertheless, present many remarkable points worthy of investigation and inquiry.

Wandering along the banks of the Rhine or up the valleys which intersect them, two points connected with the rural economy of the country soon forcibly press themselves upon the notice of the traveller; these are, first, the abundance of fruit-trees, and, second, the importance given to the growing and cutting of wood for fuel. Respecting the first of these—namely, the abundance of fruit-trees—there is no time of the year of which evidence can be so strikingly witnessed as in early spring. We have walked along roads, and, looking up to the rising grounds beyond, have seen them literally white for acres with the blossom. Fruit-trees stand like sentinels along the roadsides, stud the hillsides and the valleys like sharpshooters, or fill the fields and the plains with the phalanx of the orchard. Nothing can surpass the charm of a walk in these districts when the trees are in full bloom. The exquisite colouring, the excessive richness and quantity of the blossoms—to which, indeed, we have never seen a parallel in our colder climate—literally covering every inch of the surface; the air filled with a thousand scents from odoriferous plants and wild-flowers, while above is the hush and hum of insect life, and overhead a cloudless sky with a depth of blue rarely seen

with us. Fruit-trees yield a large profit to the peasants; from cherries alone large revenues are derived by the villages. The greatest care is taken to preserve the boles from the attacks of insects; and in many places it will be observed with interest that the trees are trained so as to throw their arms as horizontally as possible, thus spreading out a large surface to the sunlight and air. The trees, as a rule, are loaded in spring-time with a profusion of blossom, and so heavy is the consequent produce at times that the branches have to be propped up. Indeed we have frequently noticed that the trees have been trained so as to throw their branches along the top of a framework, under which a most delicious arbour may be and often is made. It will be worthy of some outlay of time for the traveller to note the way in which the standard-trees of the garden are trained—almost every village or town has its beautiful garden in the near vicinity. They are generally made to throw all their branches towards the top of the tree and to spread them out in a horizontal direction so as to form a species of table of fruit and verdure. Not seldom have we, indeed, seen them so trained as to have the appearance of a flat ring: and on looking down upon this from a height we saw that the ring was concentric or annular, the result of this arrangement being very beautiful in appearance and admirably calculated to expose a large proportion of surface to the sun and air. Nor should the traveller omit to examine the way in which dwarf fruit-trees are trained, and it will be no small matter of surprise to him to see how astonishingly prolific they are. One word as to the mode of training gooseberry trees or bushes. They are generally made so as to throw out their horizontal branches at the upper part of the stem—not, like ours, all the way up. They take up less room in this way, and yet, being so much exposed to the light, are very fruitful. Another advantage is that the fruit is never spoiled with heavy plashes of rain, which often happens to fruit trained like ours so near the ground. We have also noticed gooseberry-trees trained espalier fashion, forming thin walls of fruit-tree along the sides of the walk. Nothing could exceed the rich beauty of their produce when thus grown.

The peasants of the Rhine towns use fruit in a variety of ways. Apples and pears are pared, cut up into pieces, and then, strung upon cords, are hung up to dry. The Americans have borrowed this fashion; but we rather “guess,” as they would say, that they have gone ahead of the people from whom they have borrowed it by using a small machine to perform the operation of paring, that go-ahead people having no time to perform it in the old-fashioned way still in vogue on the banks of the Rhine. When cooked, or rather steeped in water, covered with a dish and set on a stove, they afford with sugar delicious eating. They are eaten by the peasants with their meat. Plums, apricots, and grapes are preserved in a sort of rude fashion, and add to the dainties of a German dinner. Plums also are made

use of largely to form a preserve used in place of butter. Preserves, however, as a rule, are not made in Germany to suit English tastes. The same remark may be made of the general cookery, which is villanously bad. Chestnut-trees form a very important feature in the woods and along the roads of the Rhenish districts. The nuts are consumed in large quantities by the peasants, being by preference boiled in place of being roasted, as with us. They eat pleasantly enough in this way. In wandering along the valleys the traveller is often agreeably surprised by stumbling upon lots of walnut-trees with their deliciously-smelling leaves. They are not grown in the flat cultivated places in the lower levels, as their leaves are said to exercise a destructive influence on the soil: we are not aware whether this is merely prejudice or a fact. The fruit-trees skirting the roads and by-roads of all the districts—so near, in fact, in many places that the fruit drops in the very path of the passers-by—it may be supposed that it is very open to the attacks of weary travellers, and, above all, of fruit-loving, orchard-robbing youth. Although no apparent means are offered to the consideration of the tourist by which the contents of trees and orchards are defended against such predatory acts, still we believe that in reality no small pains are taken by the village authorities so to defend them. True, the appetites of Rhenish youth are in some measure pallied by the wayside droppings of over-burdened trees, to which we believe custom no less than humanity has declared them entitled; nor can we, in view of such a state of matters, fancy any wind which blows only strongly enough when the fruit is ripe, being considered by the youths otherwise than lucky and devoutly to be wished for. Moreover, wild fruits abound in the valleys; but whether a ban is laid upon those as upon the fruits of the orchards below, we know, but should think, not. One village rule or law we should deem very efficacious against fruit-trees being robbed is, that if any one is caught in the act he is held immediately and in virtue thereof to be the perpetrator of *all the* thefts which have been done any time that year preceding his apprehension. Terrible stretch of power this, and the aptest illustration we have yet met with of the saying, "In for a penny in for a pound." Yet fruit is stolen on the banks of the Rhine nevertheless, and will be, so long as boys are boys, and men's "teeth water" for luscious fruit.

The absence of the open grates in rooms of German houses, and the presence of the ugly black, or the more pleasant-looking porcelain but not less cheerless, stove—the heaps of wood, some in the court-yards of the houses, or at the sides of doorways—all testify that fuel is not there the "black diamonds" which give England so much of her material wealth and power. The stoves are remarkable for the diversity of form which they assume—some are simple, and some are most complicated-looking affairs; some are stunted, black, and deformed; some raise their mighty bulk in dazzling porcelain, and are so high as to reach, in some instances, high

above the tallest man. We have in the old-fashioned inns met with some of most portentous dimensions, and on seeing the tiny blocks of wood which were thrown into their capacious bowels, we were reminded of Falstaff's "halfpenny worth of bread to a half-crown's worth of sack;" but, at the same time, have confessed ourselves surprised at the amazing amount of heat which so small a portion of wood consumed in it could give to the large surface of the huge structure. Wood being there the almost universally used fuel—although coal from England, and the coal-mines in the valley of the Ruhe on the Rhine, is sometimes used—the growing, cutting, and selling of wood to meet the demand which must exist so largely for it, becomes a very important feature of the rural economy of Germany, and is worthy of more than a merely passing notice. Wood being of such value, the forest laws are numerous and stringent. These, doubtless, originated at a time when the conservation of the forests was more thought of for the purposes of the chase than for the supply of wood; but as the population increased and the demand for fuel in like proportion, it became the interest of the great men of the districts so to arrange their forest system that a regular supply of fuel could be at all times obtained. The foresters are a numerous and hard-working body of men, presided over by a nobleman with a long-syllabled title, "head of the hunters," which indicates, by the by, that the origin of the forest laws was as we have stated above. "The whole country," says Mr Banfield, whose account of the forest economy we shall follow, "is divided into districts that usually correspond with the civil and judicial divisions, and according to the extent of forest land in each district is the number of foresters appointed to inspect and watch over the district, large and small. Whatever be the size of the woods, every tree is known, and destined either to a long or short growth, according to its promise of sturdy vitality or its liability to decay. . . . The trunk of the tree forms the object of the forester's care, and the regular quantity that can be felled, with the mode of keeping up the supply, is what he has to calculate." The forests are made up of oak, birch, and fir trees; the two latter are those chiefly used for firewood, the former for building purposes; although oak, we presume not of the best quality, is often consumed in the stoves. We have said before that the forest laws are numerous and stringent; we do not know whether the forest penalties now to be named are still enforced by the Duke of Nassau, but some years ago they were. We made further inquiry on this point while in the duchy of Nassau, and learnt that stringent laws are still in force; so much so that the leaves and rough grass are not allowed to be removed. Thus, for cutting a load of firewood a child was fined 34 kreutzers (there are three kreutzers in a penny); 54 for a man; the fine being doubled if the wood is green. For taking a load of dead leaves, 20 to 26 kreutzers

for a child, 46 for an adult. For a load of green grass torn up by the hand, a child 30, an adult 50 kreutzers. If a sickle or scythe be used, the fine is doubled; the same for a second offence; while for the third, imprisonment is the result. Bird-nesting is a perilous amusement and a costly, for if one is caught—not having previously had the consent of the foresters—taking a nest of even the most common of the singing-birds, a fine of 5 florins (a florin, or gulden, is 1s. 8d. of our money) is imposed; for taking a nest of nightingales, 15 florins; if these depredations are committed in the pleasure-grounds, of which, to the great delight of the tourist, there are many in the duchy, these fines are doubled. There may be some really urgent reason for having laws like these so stringent; but, with a well-known traveller, whose graphic delineations of Continental scenery and manners are the delight of all who have read them, we cannot help thinking that it does seem very hard that the poor peasants who inhabit the forests, almost boundless in extent, numbers of the trees of which are actually rotting into dust, “should, by the laws of their country, be rigidly forbidden to collect fuel to cheer the inclemency of the winter, or even with their fingers to tear up a little wild grass beneath the trees for their cow.” From the admirable system on which every detail connected with the rearing of young plants, the planting, the rearing, and cutting of the forest trees, is carried out, we believe that there cannot be a better school for any one interested in this important branch of rural economy to study in than the forest districts of Germany. There is no difficulty in becoming acquainted with these details—every information is willingly afforded by those best calculated to give it; and useful works on the subject are not difficult to be had. We may hereafter return to the subject; meanwhile we shall usefully close this paper by giving a few rotations of crops adopted in different districts of Germany, which will suggest some points of consideration to our readers. If the traveller takes the railway from Treves to Saarbruche—we shall have in a future paper a note or two on another beautiful route, namely, from Treves to Coblenz by the Moselle, a lovely river—and from thence to St Wendel, on the way to Bingen on the Rhine, he will pass through a pretty country, formerly belonging to the family of Hohenlohe, but now belonging to Prussia. The country is fairly cultivated, the cereal crop being chiefly barley, rye, oats; lucerne is largely cultivated, together with clover, vetches, and pease. The soil is sandy chiefly, and the rocks of the district are red sandstone. Irrigation is carried on pretty extensively for raising grain food for the cattle, which are almost universally stall-fed. A rotation used on a well cultivated farm near St Wendel is as follows:—First year, potatoes and carrots, these last sown in drills—the land for these crops is richly manured; second year, barley or oats; third year, rye, with which the clover is sown down; fourth year, clover; fifth

year, rye. In carrying out this rotation a second time, the pease or vetches are substituted in the fourth year for the clover. Where new land is broken up, and is generally covered with brooms and copsewood, a crop of oats is usually taken off the first year, followed by a crop of potatoes, after which the rotation commences. Wages of men may be stated on the average as 10 silver groschen, or 10d. a-day in summer, 8d. in winter—no rations being included; women labourers from 6d. in summer to 5d. in winter. In going from St Wendel to Mannheim by way of Neustadt, the traveller will have an opportunity of passing through a district which not many years ago was made up merely of sterile, sandy, and heath-covered land, but which now bears rich crops of forage. The transformation, so pleasant for an agricultural eye to contemplate, has been effected by painstaking working of the land, by careful levelling, by the liberal use of manures, and by an elaborately arranged system of irrigation. The sandy soil in the neighbourhood of the villages, which, according to popular notions of agriculturists, could bear but scanty crops, under a prodigal application of manure yields rich produce in the shape of barley, turnips, and clover. This in fact bears out Professor Voelcker's statement, that the sandy soils are the best for the use of liquid and other manures in quantity, yielding large returns. What we would suppose to be a very exhausting rotation, especially for such light soil, is adopted in this district—viz., alternate crops of potatoes and rye. Between Hombourg—this place must not be confounded with the celebrated watering-place near Frankfort-on-the-Maine—and Neustadt another exemplification may be met with of what good results painstaking industry can obtain from the most unpromising materials in a district which not long ago was what was then deemed an absolutely sterile moorland, but which is now nearly all occupied with smiling meadows or waving corn-fields. Not far from Hombourg is a well-cultivated farm, on which the following rotation is adopted: first year, fallow, on which four or five hundred sheep are folded; second year, rye or wheat; third year, pease; fourth year, potatoes; fifth, oats, with clover; sixth, red and white clover, with ryegrass and other grasses; the seventh, eighth, and ninth years are taken up with pasturage; while the tenth and concluding year of the rotation gives oats or buckwheat. Land of less valuable quality on the same farm is submitted to the following rotation:—first year, potatoes, manured with 24,000 kilos the hectare; second year, rye; third, clover or vetches, mixed with pease, manured with 12,000 kilos per hectare, with 25 hectolitres of chalk; fourth year, rye; fifth, potatoes, not manured; sixth, oats or barley, manured with 24,000 kilos to the hectare; seventh, clover; eighth, rye. In the neighbourhood of Worms the following rotation is adopted: first year, fallow, manured with 77,000 kilos to the hectare; second year,

colza ; third, rye ; fourth, potatoes ; fifth year, barley ; sixth, clover ; seventh, oats. Another is—first year, fallow, manured with 27,000 kilos to the hectare ; second, colza ; third, rye ; fourth, vetches ; fifth, green crop ; sixth, barley ; seventh, eighth, and ninth, lucerne and samfour mixed ; tenth, potatoes ; eleventh, maize, barley, or oats ; twelfth and thirteenth, white-clover and grasses fed off by sheep ; fourteenth, wheat.

From St Wendel taking the railway to Bingen, that beautiful part of the Rhine is soon reached. Opposite to this is Rudesheim, the beginning of that part of the country where the finest grapes are produced ; and, indeed, almost every crop of fruit, vegetables, and cereals. Nothing can surpass the richness of this district, which is known as the Rheingan. In passing from Rudesheim to the celebrated watering-place of Wiesbaden, the most fertile part of this country will be seen. The transit is quickly made by railway. The soil of the district immediately in the neighbourhood of this charming and much-frequented watering-place appears very light and sandy in many places, is alluvial, and in some parts especially adapted for wheat. Meadows also for the cultivation of artificial grasses are to be met with, the produce being cut, and, with the usual loss of labour, carted slowly along to the cow-houses of the district, milk being, as may be supposed from the number of strangers, a material for which there is great demand. No rotation of crops is followed as a rule in the district ; but in a well-cultivated farm the following is the rotation adopted : first year, fallow well worked and manured ; second year, colza ; third year, rye ; fourth year, wheat ; fifth year, barley ; sixth year, potatoes ; seventh, wheat ; eighth, clover ; ninth, oats. The great fault of this rotation is the frequent repetition of the cereals. Fruit, as has been before said, is largely cultivated in the duchy. Apple and pear trees are met with in abundance ; near Frankfort particularly so. Cider, therefore, may be supposed to be largely drunk, nor is the supposition wrong ; only it is not the delicious drink with which the inhabitants of our apple-growing districts are acquainted ; the first essay at a draught of it made us mentally resolve that unless under very peculiar circumstances that draught would also be our last. Yet habit has wonderful power, for the burly bourgeois who invited us to share his bottle informed us that he drank a great deal of it, at which, we confess, we marvelled much. Beer is, we may here say, largely drunk in the duchy—and capital beer it is too, and cheap withal, a bottle costing from 6 to 8 kreutzers, or from 2d. to 2½d. The flavour is peculiar, and not a favourite one to a British palate, but it rapidly loses this peculiarity. Light wines are cheap, and are consumed pretty extensively in the drinking-shops of the district. In the upper or hilly parts of the duchy, as near Schwalbach, the climate is not so genial, and the season is later ; wheat is not much cultivated—rye being the principal grain grown.

Potatoes are largely cultivated. The soil generally is light, but requires liberal manuring. Cattle, as in the Rhine, are all stall-fed.

The country immediately around Frankfort is well cultivated, and there are several large farms between Frankfort and Mayence, which are largely cultivated and of good quality. Mayence is one of the most important of the German markets, the town is the capital of the Rheinhessen province in the grand-duchy of Hesse; and the sole business of the people of the country around the city is agriculture. The farms are almost universally small, and cultivated by peasants. At Mayence may be seen the "garden-fields," which Mr Banfield thus describes:—"These garden-fields lie enclosed between the walls of the town and the outer range of works. . . . Not only has every citizen his little plot, to which he or his family, with male or female servants, adjourn to drink coffee, smoke, and delve the soil every afternoon; but nursery grounds on a small scale may be found, which disseminate the new plants and flowers as they come into use or into fashion. A flower-show is held twice a-year at Mayence, at which prizes are distributed. In Frankfort a love of flowers is a pleasing characteristic of the richer inhabitants, especially as they lend their aid to extend this desirable taste among their poorer neighbours. The flower-show takes place several times in the year, and it is combined with a lottery for the purchase and distribution of the plants. Thus the poorer gardeners are sure to be indemnified for any extra cost to which they go in rearing plants." A rotation adopted near Mayence is, first year, fallow, manured; second year, colza; third, rye; fourth, wheat; fifth, barley; sixth, potatoes or turnips; seventh, wheat; eighth, clover; ninth, oats. The solid manure used is carefully washed with the liquid manure obtained from the cattle; and which is allowed to remain in the tank for fifteen days, till a proper degree of fermentation is insured.

Having recommended the traveller, in making the tour of the Rhine, to stop at several places on its banks and to explore the lovely and interesting valleys which branch off from them on either side, it will be but right to name the best places at which this may be done.

Taking in the first place that part of the Rhine which embraces by far the most romantic of its scenery—namely, from Coblenz to Bingen—we would advise the tourist to take the boat from the first-named of these places to Braubach (pronounced Browbaugh; the latter syllable, with that sound so easily come at by a Scotch tongue, so difficult to be attained by an English, is met with in the word loch). There is no station at Braubach, but the boat lands passengers at a village immediately opposite, named Overspei. The small boat into which the traveller descends, assailed as he does so by the demand of the red-jacketed luggage-man of the steamer for the odious tax on his purse and patience, "drink-money," will take him

across the river to the landing-place at Braubach. If this traverse is made at the time when ours was made—namely, at sunset, when the sun was streaming down its rays from over the ridge on which the lovely Castle of Stolzenfels stands, throwing some parts into gloomy shade, lightening up others with its dazzling rays, and making the river's face a sheet of burnished gold—he will not the less thank us for counselling him to stop at this charming spot. On landing at the tiny pier, he will see towering over the town at an enormous height, and crowning a startlingly developed conical rock, the Castle of Marksburg, occupying by far the most commanding position of all the castles of the Rhine, as it is by far the most interesting. For it is perfectly complete, just as it was in the days when occupied by the Counts of Marksburg, men of no small note in their day amongst the “robbers of the Rhine,” as the castellated chieftains of that river are now so unceremoniously called. If the reader has no objection to test his climbing powers, he should by no means omit making a visit to this admirable structure; and, after winding through its gloomy rooms, climbing narrow staircases, and viewing its dungeons, he will be rather impressed with the notion that, however romantic it may be to think over and talk about the “good old times,” still the new times in which we live are somewhat better in every respect. One of the most magnificent of the views on the Rhine can be obtained from the principal tower of Marksburg; and lovely valleys of the class we have written about will be seen intersecting the country on both sides of the river. A very lovely drive may be taken from Braubach to Ems, the beautiful watering-place; or it may be reached by going to Lahnstein, and from thence the whole journey being compassed by rail. But we should advise the reader to take the road through the valleys. Nor should we omit counselling him to walk along the Rhine bank in the up direction till he comes to the valley in which the famous mineral spring, the “Dinkhold,” is situated. The entrance to the valley is about a mile and a half from Braubach. This “brunnen” or well, once so famous in the olden times, is now deserted; no crowds wait round to be helped to its sparkling waters by an attendant nymph, so that the tourist will better provide himself with a drinking-glass. But though its waters bubble up briskly as of yore, and dance in the glitter of the sunlight which pours down into the lonely valley which few strangers visit, they are not the less delicious to the thirsty traveller, nor less potent for good to the weary and the nerveless health-seeker. You will probably be tempted to drink more than you could fancy you have room for; but when you walk back to the snug shelter of the Hotel de Phillipsburg you will be surprised to find how much you have to spare for the capital dinner you will get there, so appetising are the waters of the Dinkhold Brunnen. But if he has time to spare, let the tourist, between his first and second draughts of this delicious well, walk up the valley in which it is; and if he does not return enchanted with

the beauties which his stroll reveals to him, we fear we must class him with that man of whom the poet says that—

"A primrose by the river's brim
A yellow primrose was to him,
And it was nothing more;"

so that upon the whole we would advise him to get back to dinner as soon as possible, which he will probably be better able to enjoy. We think a month could easily be spent in the neighbourhood of Braubach on both sides of the river, yet without exhausting the natural beauties with which it is so richly endowed.

Another central point from which a series of delightful trips may be made is St Goar (if the traveller likes the sun to be nearly all day in his rooms, let him take St Goarhausen opposite). This town is farther up the river than Braubach, and is easily reached by boat or by rail—if the latter, crossing the river from St Goarhausen, at which place is the station. St Goar is a cheerful little town, nestling beneath the ruins of the stately castle of the "Rheinfels." Farther up, the traveller should stop at Bacharach and Assmanshausen, in the immediate neighbourhood of which beautiful valleys will be met with. The latter place is the best starting-point for the Niederwald, from which may be had the view of "the loveliest scenery in the world," as by a well-known writer it has been termed. The last place from which lateral excursions can be made is Bingen, situated at the junction of the Nahe with the Rhine. The tourist must not expect to find at all the stopping-places we have indicated, or at any he may choose for himself, all the luxuries of good or grand hotel living; but we can promise him that he will, at every town he stops at, easily find a hotel where the living obtained will be abundant and wholesome, and even bedroom accommodation clean and comfortable; and at prices which for moderation will astound all accustomed to those of the grand hotels of the more fashionable or more frequented stopping-places of the Rhine. Indeed we know of no way so well calculated to give the tourist correct information as to the habits, modes of living and of working of the people of the country, as this style of slowly and deliberately travelling and stopping at various places, which we have frequently referred to. Of course this plan involves more trouble on the part of the traveller, not lessened if he is not well acquainted with the language. But, on the whole, we doubt if this last difficulty is less the cause of annoyance than of a vast deal of fun and enjoyment from the mistakes—some of them excessively ludicrous—which are in consequence frequently arising. Of course much, indeed we may say all, of the comfort and pleasure of the tourist depends upon the way in which he takes things as he finds them. Some we have met with have found in everything that happened to them, and which came across them, a source only

of annoyance, and an excuse for perpetual grumbling; others would find in those very things only a fund of amusement, and opportunities for observing the habits and manners of the people. To tourists of the first class—none of the readers of this journal belong to it, we venture to say—the best advice we can give them is to stay at home; if they will travel abroad, it is, to say the least, a poor matter to find fault with things which they of their own free will have sought for; if they cannot put up with this, and are disgusted with that, surely the better way would be not to place one's self within their reach. We never met with a difficulty yet but what good nature and a determination to make things go fair and easy overcame; and we are sure that all who ever travelled abroad will bear us out in this, that in any endeavour the tourist may make good-naturedly to overcome difficulties, he will be met more than half-way by the inhabitants of the country he passes through. We have come in contact with all classes in our many rambles abroad, and with all it was truly delightful to see how eager—yet how quietly and unobtrusively eager—they were to do all they could to insure our comfort and win our smile. Wild-flowers and weeds will be found near together in every man's by-path: he is the wiser man who looks out for the flowers and avoids the weeds. It is just as easy to pick up that which will please the eye and charm us with its perfume, as that which will prove ugly and noisome. Some men have an unhappy knack of seeing, or persisting that they see, weeds where others see both weeds and flowers, and of picking up the weeds only; for our part we prefer to look for flowers. For the benefit of those who say that no flowers bloom for them, we will, as we began our paper, finish it by quoting the saying of the German sage—"There are things which you do not notice, only because you do not look at them."

PEARLS AND PEARL-CULTURE.

WHAT are pearls, and where produced? Can they be multiplied by the art of pisciculture? These are queries of some importance, if it be true that, so recently as last century, the pearls sent to London from the rivers Tay and Isla between the years 1761 and 1764 were worth £10,000.* It is singular, observes Mr Tytler, "to find so precious an article as pearls amongst the subjects of Scottish trade; yet the fact rests on good authority. The Scottish pearls in the possession of Alexander I. were celebrated in distant countries for their extreme size and beauty; and, as early as the fourth century, there is evidence of a foreign demand for this species of luxury." The fame of our Scottish rivers as producing valuable pearls has of late been attracting some attention. Sums varying from a few shillings up to £40 have recently been given for single pearls; and it is stated that her Majesty and other persons of distinction willingly purchase pearls obtained from the Tay and the Don. Mr Unger, a jeweller in Edinburgh, is exerting himself in stimulating the people on the pearl-producing rivers of Scotland to cultivate this kind of industry. We have thus been led to think about pearls, and to investigate into the causes of their production: the result is, that we think pearl-culture deserving of attention. If oysters and mussels be reared as articles of food, it is worth while to consider whether the bivalved molluscs producing pearls may also become the subjects of improved culture. As there is evidence that they may, we think it may interest some of our readers to make them acquainted with it.

But we have first to consider the vexed question, What is a pearl? According to an old popular fancy, pearls are dew-drops, which are transmogrified thus, according to Boethius: "Early in the morning, the mussels, in the gentle, cleare, and calme aire, lift up their upper shells and mouthes above the water, and these receive of the fine and pleasant breath or dew of heaven; and afterwards, according to the measure and quantitie of this vitall force received, they first conceive, then swell, and finallie produce the pearle." Poets having taken up this fancy, it survived until the researches of Mr Gray and Sir Everard Home demonstrated that pearls are merely the internal pearly coat of the shell, which, from some extraneous cause, has assumed a spherical form. It is supposed that the shell of the mollusc having been penetrated by one of its enemies, the creature repels the invader by the secretion of nacre; or, where sand or other small bodies have been accidentally introduced, they are covered with nacre as a protection against the irritation caused by their presence. A pearl having been once formed, the animal continues

* Forbes and Hanley, 'British Molluscs,' ii. 149.

depositing concentric layers of fresh nacre. The pearls are usually of the colour of the part of the shell to which they are attached. "I have observed them," says Mr Gray, "white, rose-coloured, purple, and black, and they are sometimes said to be of a green colour. Their lustre, which is derived from the reflection of the light from their peculiar surface, produced by the curious disposition of their fibres, and from their semi-transparency and form, greatly depends on the uniformity of their texture and colour of the concentric coats of which they are formed." *

Sir Everard Home prides himself as the discoverer of the true nature of the pearls. "I shall now explain what a pearl really is; and if in the course of my explanation I shall prove that this, the richest jewel in a monarch's crown—which cannot be imitated by any art of man, either in the beauty of its form or the brilliancy and lustre produced by a central illuminated cell—is the abortive egg of an oyster enveloped in its own nacre, of which it annually receives a layer of increase during the life of the animal, who will not be struck with wonder! In my investigation of the mode of breeding of the oyster and mussel, when the ova were examined in the microscope, we commonly found round hard bodies, too small to be noticed by the naked eye, having exactly the appearance of seed-pearls, as they are called, in the ovarium, or connected with the surface of the shell in contact with the membrane covering it; which led me to consider this to be the situation in which pearls are originally formed, more especially as here they were not only very small, but uniformly of the same size, and when found more and more distant from this spot they had increased in size. These facts led me to conclude that the ova which prove abortive do not die and drop off at the same time that those which have been impregnated pass into the oviduct, but remain in their capsulæ, which, being still supplied with blood-vessels, go on increasing for another year; their surface then receives a nacral covering with all the other surfaces of the shells, and they lose their attachment or become imbedded in the shell; this is in some measure proved by pearls being met with perfectly spherical—others in which the pedicles are included in the nacral coat—others, again, more or less buried in the nacral coat of the shell.

"As pearls have their origin from so small a nucleus, it is not surprising that there are so few of a large size, since it is probable that oysters of great size, which will depend upon their age, live in deep water beyond the reach of man." †

This conclusion of the comparative anatomist is not acquiesced in by writers on natural history.

"This," observes Mr Johnston, "is far from being true. I will

* 'Annals of Philosophy,' 1824.

† 'Comparative Anatomy,' vol. v. p. 313.

not deny that the fact may be, in not a few instances, as stated by Sir E. Home—for the ovum may accidentally fall into a situation where it shall become a source of irritation, like any other extraneous substance; but that it is often the case is contradicted by numerous observations, and by the true theory of the formation of pearls. Professor Baer of Königsberg, aware of Home's theory, undertook an investigation of it in the fresh-water mussels of Germany; and the result was, that he never met with pearls in the ovaries, liver, kidney, or any of the internal organs. The pearls were always situated either in or under the skin of the back, where it is close to the shell."

This is certain—the animals producing pearls possess the power of covering with concentric layers of nacre portions of their shells needing to be strengthened, or objects introduced accidentally or by design. The Chinese have long practised the art of stimulating the secretion of nacre by the introduction of mother-of-pearl roughly filed into a plano-convex form, like the top of a mother-of-pearl button. Mr Gray, observing in the British Museum some very fine pearls thus produced, tried the experiment of introducing similar pieces of mother-of-pearl into the shell of the *Anodonta Cygneus* and *Unio Pictorum*. "If," he observes, "this plan succeeds—which I have scarcely any doubt it will—we shall be able to produce any quantity of as fine pearls as can be procured from abroad."

It is to be regretted that the result of this experiment is not known. As it deserves to be repeated, we give Mr Gray's account of the *modus operandi*:—"I found the introduction of the basis of the pearl attended with very little difficulty, and, I should think, very little absolute pain to the animal; for it is only necessary that the valves of the shell should be forced open to a moderate breadth, and so kept for a few seconds by means of a stop, and that then the basis should be introduced between the mantle and the shell by slightly turning down the former part and pushing the pieces to some little distance by means of a stick, when the stop may be withdrawn and the animal will push the basis into a convenient place by means of its foot; and of the thirty or forty bases which I thus introduced, only one or two were pushed out again, and these I do not think had been introduced sufficiently far."

In order that the experimenters in this mode of pearl-producing may not be disappointed with the result, we add these observations of Mr Gray:—"In cutting these pearls from the shell, it is necessary that the shell should be cut through, so that the mother-of-pearl button may be kept in its place; for if the back were removed, as it would be if the shell were not cut through, the basis would fall out, and then the pearl would be very brittle. The only objection that can be adduced against these pearls is, that their semi-orbicular and unequally-coloured sides preclude them from being strung or used any other way than set; but this fault will always be the case with all artificially-produced pearls, as the mantle can only cover one

side of them ; and the only pearls that will answer the purpose of stringing are those found imbedded in the cells in the mantle of the animal."

In the 'Encyclopædia Britannica,' vol. vi. p. 477, we find this notice of the way of producing pearls artificially :—"The shell is opened with great care, to avoid injuring the animal, and a small portion of the external surface of the shell is scraped off. In its place is inserted a spherical piece of mother-of-pearl about the size of a small grain of shot. This serves as a nucleus on which is deposited the pearly fluid, and in time forms pearl."

Linnaeus was persuaded that pearls could be produced at pleasure by simply puncturing the shell with a pointed wire ; and pearls formed in this manner are preserved in the Hunterian Museum.

But enough as to the mode in which pearls may be formed. The process of their artificial formation is so simple that it deserves to be the subject of further experiment.

What are the creatures by which pearls are produced ? They are chiefly bivalved molluscs—the edible mussel, the fresh-water mussel, and what is improperly termed the pearl-oyster. Pearls are also found in the oyster of the British coasts ; and we have three found in an oyster presented at table in Edinburgh. The greatest pearl-fishery in the world is off Ceylon, which at present is of especial interest, owing to Government having resorted to the formation of artificial oyster-banks, suggested by the method recently introduced along the shores of France for repeopling the wellnigh ruined banks of the edible oyster. It is necessary to have recourse to artificial banks, it being found that a remunerative annual fishery cannot be obtained, owing to the banks being exposed to the violence of ocean currents, which, by washing sand into the interstices of the rocks, often destroy the young oysters over a considerable area. The oysters, moreover, are exposed to the pernicious influence of the *soorum*, a species of *modiola* like a mussel with a swollen face. The Tinnevelly pearl-banks, which in 1861 yielded 15,874,500 shells, realising a profit of more than £20,000, were in 1863 found to be in so unpromising a condition that no fishery was attempted. It is to remedy the uncertainty of this valuable fishery that Dr Kelaart, after investigating the nature of the pearl-oyster (*Meleagrina margaritifera*), declares it as his opinion that he "sees no reason why pearl-oysters should not live and breed in artificial beds like the edible oysters, and yield a large revenue." He has ascertained, by his experiments in Ceylon, that the pearl-oysters are more tenacious of life than any other bivalve with which he is acquainted, and that they can live in brackish water and in places so shallow that they must be exposed for two or three hours daily to the sun and air.

Captain Phipps, superintendent of the Tinnevelly pearl-banks, convinced that artificial nurseries for the young oysters are the only

means to insure a remunerative fishery, has succeeded in getting these established on a bank in the harbour of Tuticorin.

In compliance with custom we have spoken of the pearl-oyster, but the animal is really a mussel, having, like it, a *byssus* or cable by which it secures itself to the rocks. Dr Kelaart's researches in Ceylon have proved that it possesses the power of casting off its byssus at pleasure. We trust that this only recently-ascertained fact will attract the attention of the Acclimatisation Societies in London and Paris, and induce them to remove the pearl-oyster from its native beds and locate it in the seas of Europe.

At all events, now that the former of these societies has accepted a gift of fresh-water mussels from the Tay with the design of introducing them into an English river, we hope that something will be done to encourage the transportation of the mussel (*Unio margaritifera*) to the many rivers and lakes suitable to their production. The mussels of the Tay and the Don in Scotland, of the Conway and the Irt in England, and of several rivers in the north of Ireland, have long been known to yield pearls, often of great value. But the natural history of the animal has been little studied; its ability to bear transportation to a distance, the means of rendering it prolific, and of developing its pearl-producing powers by placing it in favourable localities, or by such artificial processes as we have indicated—all these are points about which little is known, but as to which we hope we shall soon know more. Should any of our readers be induced to search for pearls, we give them this hint from an old writer,—“The shells that have the best pearls are wrinkled, twisted, or bunched, and not smooth or equal as those that have none.” Should they fall in with any of good size and shape but deficient in colour, let them remember this observation of Sir Alexander Johnston, for many years president of His Majesty's Council in Ceylon:—“The pearl is composed of strata or scales which are easily removed by a skilful hand, without injury to that below, which retains all its brilliancy. Pearls of a large size and perfect form but discoloured, have been bought at a low price, but became exceedingly valuable by removing one or two of the upper coats.”

D. E.

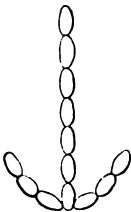
RETROSPECTIVE NOTES ON FARM CROPS AND CROPPING.

No. IV.

HAVING in our previous papers gone somewhat fully into the details of wheat-cultivation, we now propose to present a few notes on the diseases of this the most important of our farm crops. This department of our paper carries with it many considerations of the highest value; for it is plain enough that we may take the utmost pains to insure cultivation of our crop, and yet lose it quickly enough by the ravages of disease—all the more dangerous because so insidious, and the origin and progress of which are so invested with doubt and difficulty.

Following Professor Henslow's classification of the diseases of wheat, we shall give our notes under the two heads of, first, "diseases of vegetable origin," and second, "diseases of animal or insect origin." The diseases under the first class owe their origin to the attacks of parasitic fungi. A parasitic fungus is a cryptogamous or cellular plant which grows in contact with organised matter, never deriving its nutriment directly from the soil, water, or atmosphere, like other plants, but living by imbibing from the plant or organised body on which it grows the juices which support it. This nourishment is drawn through the medium of the "stalk," or "stem," or "spawn" of the fungus, called in the language of botany its "mycelium." The fungus is totally devoid of flowers, but is propagated by what are called "spores," or sometimes "sporules." These are generally colourless, but if possessed of colour, that is never green. Fungi, as a rule, attain no great size, and are small compared with cryptogamous plants, as ferns, to which they are allied; many of them are so wonderfully minute as to require the highest microscopic powers to make their presence manifest; hence the obscurity under which the subject of the investigation of their habits rests; and it so happens that it is amongst this class that

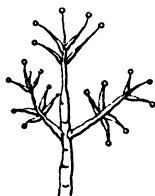
Fig. 1.



those fungi are met with which are the causes of the most common of the diseases which infest our graminaceous plants. These minute plants assume different forms; sometimes, as in the case of the fungus which we know by the name of mould, being made up of a series of minute sacs or cells strung together by a bead-like process, as in fig. 1, each of which may be separated from the other, and yet—as is supposed—still remain reproductive. Other fungi assume still more complicated, and in many cases very beautiful forms, as in fig. 2, where the sporules are seen terminating the tips or extremities of the thread-like processes. Professor Henslow mentions that "Fries, one of our greatest authorities on

this branch of natural history, calculated that a particular fungus might contain *ten million* of sporules; while Mr Bauer measured the spores of the species of fungus (*Aredo fœtida*) known as 'bunt' or 'smut bells' at $\frac{1}{10000}$ of an inch in diameter; so that a single grain of wheat, measuring only the thousandth part of a cubic inch, would contain 4,000,000 of sporules." Some idea may thus be formed of the astonishing reproductive powers of the parasitic fungi which infest our farm crops.

Fig. 2



"Of these parasitic fungi, some," says the authority we have already quoted, "are restricted to one species of plant, some to another; but, generally speaking, most of them are capable of living upon more than one species of the same genus, where of course we might expect the resemblance in all points to be very close. Some fungi confine their attacks to the seeds, others to the stem or leaves, and some even to one side only of the leaves. One of those which attack wheat lives only on the grain; another more particularly attacks the short stalk (*the pedicel*) on which each flower is seated, whilst three . . . are restricted to the straw, chaff, and leaves; but all five live at first beneath the epidermis, and not upon it. . . . It is the extraordinary minuteness of the sporules of these fungi which allows of their being absorbed by the roots, and probably also through the pores of the stem and leaves of the plants; and thus they are conveyed by the sap to the various parts where they are enabled to germinate, grow, and fructify. The sporules of fungi appear to be everywhere dispersed through the atmosphere, ready to germinate wherever they may find a dead or living subject in a condition suited to their attacks. Common mouldiness, for instance, which so readily forms on many substances in a moist situation, is the most familiar example of the inconceivable numbers in which the sporules of minute fungi are everywhere diffused."

We are now prepared to detail briefly the various diseases attacking wheat arising from the presence of fungi: the first of these we notice is that known as "smut." Like all the parasitic fungi attacking wheat, the fungi producing the disease so called appear in the plant in the form of masses of dust. The botanical name for the fungi now under notice is *uredines* (from the Latin *uro*, I burn, from the scorched appearance they give to the plants which they attack). The "smut" is formed of the spores of an uredo called the *uredo segetum*. The sooty powder resulting from the attack of this fungus appears on the flowering parts of the plant; the pedicels or little stalks on which the flowers are seated swell, become very flabby in appearance, and become ultimately filled with black dust. The smut fungus is often confounded with the bunt fungus (next to be noticed); but although resembling it in the colour and shape of the deposits of dust, these deposits are not half so large, while they have none of the disgusting odour which distinguishes the bunt fungi. The smut fungi are not so much dreaded by the farmer as the bunt fungi, inasmuch as the spores have generally dispersed before the corn is cut, while they impart no

disagreeable odour to the flour which may be made from the corn infected by them. The smut or dust brand is comparatively rare in the wheat crop, common, however, in the barley, more so in the oat, and not met with in the rye crop.

The "bunt" or "pepper brand" fungus is much more dreaded than the smut: the botanical name for it is *uredo foetida*, so called from the peculiarly disgusting odour it imparts to the infected grain. When an infected grain is crushed, in place of flour a black, oily, and foetid mass is exuded; the interior of the ovary is entirely destroyed, the only part remaining being the integument, or outer skin, which serves as a case or sack to contain the spores, which amount, as we have already observed, to the enormous number of four millions in one grain. Fig. 3 shows the sporules of the bunt fungus in their mycelium—their diameter being about the six-hundredth part of an inch.

Fig. 3.



The "rust," "red-rag," "red-gum," or "red-robin"—for by all these names is it known, although the first is the most general—is the result of the attacks of a fungus known as the *uredo rubigo*.

Fig. 4.



It forms yellow or orange-coloured blotches or powder-spots upon the stem, the leaves, and the chaff; and so common is it sometimes that a whole field of wheat will have quite a red tinge given to it. In fig. 4 we give a sketch of the sporules. Professor Henslow states, with reference to "rust," that he believes agriculturists have confounded under this name, or the names we have above given, the attacks of what systematic botanists have distinguished as two distinct species of fungi—one of these we have named above is the *uredo rubigo*, the other is named *uredo linearis*. Of these two

Fig. 5.



Fig. 6.



species the Professor conjectures that, whilst the spore of the *uredo rubigo* undergoes no change, that of the *uredo linearis* is merely "the young state of a distinct form of spore which, when further advanced, is called *puccinia graminis*," this last fungus being that which produces the disease called the "mildew." The common appearance of the straw of wheat attacked by mildew is represented in fig. 5. The ripe spores are of an intensely black colour; they are club-shaped at the head, as at *b* in fig. 6, divided into two chambers as shown, each of which contains a number of sporules. These club-shaped heads spring from tapered stalks. The patches on the straw or

leaves, as in fig. 5, are composed of an immense number of these spores—in such profusion, indeed, that they sometimes burst through the epidermis of the stem and leaves, “that the whole plant appears as if it had been scorched.” In fig. 6, *a* represents part of the straw. The Rev. Mr Sidney, in an able paper in the ‘Royal Agricultural Society’s Journal’ on the “Parasitic Fungi of the British Farm” (to which we are indebted for the basis of our illustrations), draws attention to the importance of not confounding the true mildew, which we have described and illustrated above, with “another black fungus, which gives a dingy aspect to whole fields towards harvest, and is often called mildew, but which never attacks a plant till it is previously diseased, and which, for want of any other name, I am obliged to announce by its botanical name, *cladosporium herbarum*.” In fig. 7 we give an illustration of its appearance on the straw, and in fig. 8 an illustration of the sporules, from which the difference between this and the real mildew will be at once seen. As already noticed, Professor Henslow is inclined to believe that both rust and mildew proceed from the same fungus (*uredo linearis*) “under different forms or states of fructification.” The Professor states that he has observed the mildew fungus (*puccinia graminis*) mixed with the rust fungus (*uredo rubigo*) in a way which strengthens his opinion: further observations are, however, required to decide the point.

Fig. 7.

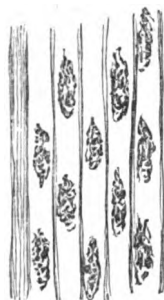
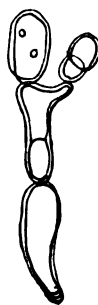


Fig. 8.



A popular notion connected with the blight of wheat by mildew is, that “the berberry bush (*berberis vulgaris*) is in some way or other frequently connected with” its production. This opinion is, however, founded apparently upon conjectural notions, or upon carelessly-made observations, and requires to be put to the test of a rigid examination and experimenting before it can be received as correct. Although ergot is generally supposed to be a disease which attacks rye only, still, as Professor Henslow remarks, a close investigation of the wheat crop will probably result in proving that it is more frequently to be met with than is supposed. The Professor suggests that, should the ergot ever prove abundant in a wheat crop, it will be worth while to pick the diseased grains out from the rest of the sample; not only for the purpose of purifying the remainder, but for sale, the ergot being a peculiarly valuable medicine in competent hands, although it is, when partaken of in flour, highly dangerous.

Remedies for the diseases already described.—When we consider the fact that the spores of the fungus which produces smut

and those which produce *bunt* enter the plants which they attack by means of the spongioles of the roots, we see at once the necessity that exists for securing clean seed ; and further, when we know that the spore-dust which adheres to the grains is of an oily or greasy nature, we also see that the substance which we employ to cleanse the seed should be of an alkaline nature. Lime and urine are the alkaline substances used for dressing wheat-seed for the prevention of smut and bunt, and sometimes sulphate of copper : it is questionable, however, whether the use of the latter is advisable, inasmuch as it is likely to have a bad effect upon the germinating powers of the seed. The following, upon the methods employed in using lime, urine, and vitriol dressing, from the pen of a student at the Royal Agricultural College, and extracted from a recent publication, is so apposite to the point under consideration, that we make no apology for giving it here :—

“ A sack of wheat is placed on the floor in the form of a conical heap, flattened and concave on the top ; a lump or two of lime are then thrown into a bucket, and a gallon or six quarts of boiling or cold water added. A rapid ebullition ensues, during which time it should be well stirred, to insure a perfect slaking of the lime. In this state it is thrown into the concave top of the conical heap of wheat, and well mixed with a shovel till all the grains appear to have come in contact with the lime, and then left for a few hours, when it will be dry enough for drilling. This method of dressing is generally done over-night, and left in a neat conical heap (which the *superstitious old farmer used to cross with the “besom,” the handle of which was thrust into the cross*) till the morning. This eccentric method was adopted with the belief that it kept the *witch* from executing her evil designs. When urine is resorted to for pickling, it should be kept in a tub for a few days prior to using it, as fresh urine voided from healthy subjects possesses an acid reaction instead of an alkaline, which it only acquires by keeping a short time. The *urea*, a nitrogenous compound in *urine*, takes up four equivalents of water, and becomes converted into two equivalents of carbonate of ammonia—‘smelling-salts’ of the chemist—giving the whole an alkaline reaction : a condition which is necessary to insure the removal of the smut-balls.

“ Where urine is used, the wheat may be dipped into it ; or the former may be poured over the latter in sufficient quantity to well moisten the whole.

“ Another agent which is commonly used in pickling wheat is sulphate of copper (blue vitriol), in the following manner : 4 lb. of the vitriol should be dissolved in about two gallons of boiling water, and when fully dissolved placed in a large tub—an old hogshead cut through the middle answers the purpose very well—and add about 20 gallons of cold water. Procure a wicker basket, of suitable shape to go into the tub, large and strong enough to hold a bushel and a half of wheat. Place the basket in the liquid, and gently pour into it the wheat. By adopting this precaution the light and imperfect grains, chaff, or small seed will float at the top, and may be skimmed off the surface. Having proceeded thus far, lift the basket, and allow it to drain over the tub ; empty the same, and proceed with the next lot. This method will be found very convenient as well as effectual ; but the most effectual remedy consists in selecting a good, clean, and even sample for seed, from a climate suitable for a change, when each kind of dressing will

be found to answer the purpose. I was talking to an old farmer to-day (who had been at it for more than forty years, and he must know "summut" about it), farming over 400 acres for a nobleman—whose crops are everything that can be desired—and he told me that he never resorts to pickling his wheat before sowing, and yet it is perfectly free from "smut;" and added he used to be troubled with it when he used the vitriol. The fact is, he is more careful in selecting his sample for seed, his land is in better condition than formerly, and his crops are never remaining in that stagnant condition which favours the development of those fungoid diseases. But as the risk is so great, and the trouble so little, we cannot but condemn the system of sowing wheat without taking the necessary precautions to prevent the spread of the disease."

Some sanguine cultivators believe that it is possible by care to exterminate the fungi which produce bunt and smut in wheat; but that this hope is not well founded is evident enough when we remember that it is not the wheat alone which is infected with them, but the grasses which grow in the pastures, and moreover, which is worse, those which flourish at our roadsides. The sources, then, of a supply of sporules being so numerous, it seems as if the farmer was driven to one point only—care in the selection of the seed. And with reference to this point Professor Henslow throws out what we conceive to be a most important suggestion—namely, the setting aside some portion of land for the careful cultivation of seed-wheat. There may be, he says, some practical reason which forbids this being done; but it seems nevertheless to him that it would be "always worth while for every farmer to set aside some portion of ground to be more carefully tended than the rest, for the purpose of securing good and perfectly clean seed. Among other reasons for such a practice, he would then be able to weed his crop from every plant infected with bunt or smut before the fungi ripened." When we consider how small a space of ground would be required to raise seed sufficient for a large breadth of the wheat crop, it is difficult to see why objections could be made to this very common-sense plan. True, the careful cleaning of this plot, and the not less careful weeding-out of infected grains, would be troublesome; but if the trouble which the plan would involve is all the objection that can be raised to it, why then no more need be said. We nevertheless believe that a large proportion of the success which we wish to believe yet remains for the future of agriculture, lies in the direction of great care in those minute details preliminary to the larger and, as we now consider them, the more important operations of the farm. It seems to be but stating a truism when we say that the labour of cultivation is altogether lost if we use seed which cannot fructify; and in great measure lost if we use seed which must produce bad crops. If, then, the careful raising of good seed is objected to, it behoves the farmer to see that such seed as he has at command is really free from the fungi spores. This he can secure if he likes by dressing, and this operation should never be omitted. It would

be doing the cause of agriculture good service if a series of elaborate and carefully-conducted experiments were made, having reference to the employment of various dressings for wheat. Professor Henslow suggests the following as the "kind of experiments that may be called for." In the first place, it will be necessary to collect a parcel of thoroughly bunted or smutted wheat-seed, dividing this into a number of small packets, each containing the same weight or the same number of grains. In washing or steeping the contents of any one of these packets, which should be numbered as No. 1, No. 2, &c., the grains which float should be kept apart, and the fungi which come to the top should also be collected and placed in a packet and marked as F 1 (fungi from No. 1); F 2 (fungi from No. 2), &c. The following washes or dressings may be used:—

- No. 1. Seeds *unwashed* to serve as a comparative experiment.
- No. 2. Washed in cold water only.
- No. 3. " " scalding water.
- No. 4. " " water with lime, the proportions to be specified.
- No. 5. " " in water and brine, in the following proportions.
 - (a) 2 parts of water to 1 part of saturated* brine.
 - (b) 1 part of water to 1 of saturated brine.
 - (c) 1 part of water to 2 of saturated brine.
 - (d) Saturated brine.

- No. 6. Washed in sulphate of copper.
- No. 7. Sprinkled but not washed with lime.

To which may be added—

- No. 8. Washed with stale urine.
- No. 9. Washed with fresh urine.
- No. 10. Washed in chloride of lime and water, under which head the subdivisions (a) (b) (c) and (d) No. 5 may be used. These also may be used with the sulphate of copper No. 6, in order to test the utility of different strengths of the mixture.

Another set of experiments should next be made by selecting perfectly clean grain, and infecting them by rubbing them over with the fungi obtained from the washing of the different packets of diseased seeds as above described. This will be class

- No. 11. Rubbed grains with fungus of—
 - (a) Packet F. 1.
 - (b) do. F. 2.
 - (c) do. F. 3.
 - (d) do. F. 4.

Infected seeds should then be washed in pure water to obtain the fungi which will float, these being put up in packets and numbered. Pure or clean seeds should then be washed in various dressings as below, and then rubbed over with the fungi, as—

* By saturated brine is meant brine made by dissolving salt in water till the point is reached at which the water will dissolve no more salt. This point is called the "point of saturation."

No. 12.	Seeds steeped in lime, and rubbed with fungus of packet No. 2.				
No. 13.	do.	brine	do.	do.	do.
No. 14.	do.	sulphate of copper,	do.	do.	do.

The whole of the dressings given in No. 1 to 9 may be thus used. The experiments last named may be repeated by washing the seeds—steeped and rubbed as there described—in pure water, in order to remove any of the mixture that may adhere to the *surface*. Such, somewhat differently stated, is an outline of the experiments suggested by Professor Henslow; and as the mode of further conducting them, we beg to suggest the following: The seeds thus obtained should then be finally packed, and with each packet a note given of the process under which it has been placed; or simply marked with the number of the experiment, as “No. 9,” which will indicate that it has been washed with fresh urine. Different plots of ground should then be laid out, one plot allotted to the seeds of one packet, a slight sketch-map being taken of the whole as arranged.

No. 1. Packet No. 1, dressed as in No. 4.	No. 2. Packet No. 2, dressed as in No. 1.	No. 3. Packet No. 3, dressed as in No. 2.
No. 4. Packet No. 4, dressed as in No. 9.	No. 5. Packet No. 5, dressed as in No. 3.	No. 6. Packet No. 6, dressed as in No. 5.

It will be necessary to have the plots separated a considerable distance from each other—at least 3 feet; and comparative observations as to the conduct, so to speak, of the contents of each plot will be more easily made if the seeds are dibbled at distances of 9 or 12 inches each way. A register should be kept of each plot: the produce of each, the time when the disease, if any, appears, and the number of diseased grains obtained from each. The produce at harvesting of each plot should be carefully kept separate in packets, and labelled for further experiments or examination. All this will be troublesome, doubtless; but having conducted a large number of experiments, bearing upon different points, in this careful way, we can from our own experience promise those who may conduct similar ones a large amount of positive pleasure in carrying them out.

We have little to say of the measures to be taken, or which can be taken, to prevent the ravages of the rust fungus (*uredo rubigo*

and *uredo linariis*) and the mildew fungus (*puccinia graminis*). The spores of these fungi do not, it is understood, enter the plants which they infest by the roots, but by the more minute pores in the stems and leaves which botanists call *stomata*. The point is, however, doubtful; but as the "fungi at first make their appearance in little cavities seated immediately beneath these pores, it certainly looks very much as if the sporules entered there. The stomata are naturally exhaling organs, continually discharging, under the influence of light, a large proportion of the water which they imbibe by the root. But in moist weather the function is impeded, if in some cases it be not actually reversed, when it would be easy for the sporules to enter these invisible stomata with the moisture imbibed by them." Excessive manuring, and especially manuring directly for the wheat, is pretty well understood to be the cause of mildew and rust; and Mr Knight states distinctly that mildew is induced by foggy weather. Hence the benefit of the practice followed by some, of growing early varieties so as to have the crops off the ground before the autumnal fogs set in. It is also fairly established that wheat grown in light soils is more liable to mildew than wheat grown in heavy soils, and that spring-wheats are less liable to the attacks than winter-wheat. "Amongst the antidotes to mildew," says the Rev. E. Sidney, "I venture to name clean farming, amendment of the texture of the soil, ventilation, and letting in light, checking over-luxuriance in the young plants, growing early varieties in places subject to it, and avoiding putting in manure directly before wheat, and hoeing the wheat when young." In a word, whatever tends to make the plants become sickly, as "excess of heat or cold, drought or wet, sudden changes of temperature, poverty of soil, over-manuring, shade, &c.," tends also to the liability of the crop to be attended by rust and mildew.

We now come to those diseases of wheat arising from the attacks of insects; and, first, of the "ear-cockle," "peppercorn," or "purples." The grains of wheat infested with this disease become of a dark-green colour, which ultimately changes to one nearly black; they lose their usual oblong rounded shape, and become nearly spherical, like a small peppercorn—hence one of the names of the disease. The husks or chaff spread open, the awns are twisted, so that infected ears are easily observable. On crushing the grains thus diseased, they are found to contain no flour, but a moist cottony substance, which, under the microscope and when moistened with water, is discovered to be a moving mass of exceedingly minute eel-shaped animalculæ, and to which the name is given of *vibrio tritici*. The disease occasioned by the attacks of this animalcule is stated to be very injurious to the grain; but it is by no means commonly met with, or, perhaps, to state the matter more correctly, it is not commonly suspected. On grinding, the cottony mass of animalculæ is said to remain behind with the bran, and not to pass through with the flour.

“When a small grain of wheat is sown by the side of one infected with the *vibrio*, the young plant which springs from the former is not infected before March; but then the animalcules begin to find their way from the blighted grain into the earth, and thence into the young corn. They gradually ascend within the stem till they reach the ovale (or young state of the seed) in the flower, and even before the ear has shown itself.” A remarkable peculiarity connected with these animalcules is their vitality, which they will retain for six or seven years. Even if kept till they are reduced to a state so dry that they are easily powdered, yet if moistened with water they will at once revive. It is difficult to estimate the number which a grain of wheat may contain, but when in the young state, fifty thousand might be accommodated in the space. When full grown, the *vibrio* is monstrous in size compared with its condition while young and in the grain. The remedy for this disease does not lie in merely immersing the seed in water, for although they float at first, still they soon sink, so that they cannot be separated. By subjecting them to scalding-hot water, Professor Henslow has noticed that the *vibrio* is killed, and suggests “the possibility of exposing infected examples to a temperature that might be sufficiently high to kill these animalcules, without being so hot as to destroy the germinating powers of the corn.”

The “wheat-midge” is not by some considered an enemy of the crop worth troubling themselves about; others, however—who deem that a loss of the twentieth of a crop, which has been known to be occasioned by it, is worth considering—have paid attention to its habits and the means of preventing its attacks. The “wheat-midge” or fly, of which the name is *cecidomyia tritici*, may be seen collected in large numbers or clouds in the month of June, between the hours of seven and nine in the evening, hovering over and seeking places in the wheat in which to deposit their eggs. These eggs deposited within the blossoms produce caterpillars, the larvæ of the fly-midge, and which feed—their heads immersed in the stigmata, according to the most plausible theory—upon the juices which are secreted by the ovary, thus obstructing its growth; and this whether it has been fertilised or not. According to others, the caterpillars feed upon the pollen after it has been shed by the anthers, thus preventing the fertilisation of the young seeds. Whatever be the food the caterpillars feed upon, certain it is that their ravages effectually prevent all fruitful development of the ovary, preventing all advancement of the grain “beyond the state in which it appears at the time the flower first expands.” The length of the caterpillar is about 1-12th of an inch; it has no legs; the colour is a citron yellow. When about to pass into the chrysalis or pupa condition it spins itself a fine transparent web, which is attached to a small grain or to the inside of one of the scales of the chaff.

Seeing, as Professor Henslow suggestively remarks, that "there is a strange economy in the insect tribe, by which particular species, in certain seasons favourable to their production, are enormously multiplied," it does seem worth the attention of farmers to consider how best the increase of the wheat-midge may be prevented. As the chrysalides of this insect remain attached to the chaff-scale during the winter, it appears at first sight the best plan to burn the chaff, or to scald it for food after the grain has been thrashed out; but it appears that, in some cases, the caterpillars drop from the chaff-scale to the ground before the crop is removed, burying themselves in the soil; and, it is presumed, changed to chrysalides, they remain buried till they are finally changed into the midge. In this latter case our authority presumes that the caterpillars have been attacked by one of the tribe of insects called ichneumons, which lay their eggs in the bodies of other insects. The eggs being hatched in this strange receptacle produce caterpillars which devour the non-vital parts of their living conveyance, which thus dies, or is passed, before it is finally destroyed, into the chrysalis stage. The caterpillar of the ichneumon also passes to the chrysalis state, and remains in the body of its victim, or issues out before passing to the chrysalis state. The caterpillar of the wheat-midge has "certainly one, and probably not less than three, distinct species of those ichneumons appointed to keep it in check." The most active of these—the *platygaster tritici*—a black, four-winged insect, with a sharp pointed tail, may be seen in the months of July and August flying about the ears of wheat for the purpose of finding the caterpillars of the wheat-midge in which to deposit their eggs. By this adjustment the wheat-midge—which would otherwise probably be such a scourge as would ultimately destroy our wheat crop—is kept down. One writer, while maintaining the fact that in one year the loss sustained in the wheat crop of one district was equal to one-third of its whole amount, observing that all the caterpillars had descended into the earth by the 1st of August, counselled means to be taken for destroying them while in that situation. If, as seems highly probable, those caterpillars which *do* drop to the ground are ichneumonised, this counsel was the very worst which could be given, for, if followed, the farmer's best friend would be then destroyed.

We have now glanced briefly at the diseases which infest the wheat crops, that is, the grain. For a notice of the evils which arise to the crops through the attacks of the grub, &c., which also attacks other corn crops, we refer the reader to our notes when concluding the subject of the cereals. Meanwhile we proceed to glance at a few of the most important of several points connected with the wheat crop which have from time to time received the attention of agricultural authorities. And first, as to the varieties and the selection of seed-wheat. We have already pointed out to

the reader the suggestion of Professor Henslow, and offered some remarks thereupon as to the advantages which would accrue to farmers by raising their own seed; and it certainly does appear a strange matter that so much indifference exists amongst them as to the *kind* or *variety* as well as the quality of the seed they use. The whole subject is one invested with the deepest interest to the agriculturist desirous to obtain the maximum of produce with the minimum of outlay. In an exceedingly interesting and able paper by Mr W. Wallace Fyfe, in the last number of the Journal of the Bath and West of England Society, on "Farm Seeds and Seeding,"* there are some very suggestive remarks on this very point, of which we give here a very brief *resumé*, referring the reader to the article itself for fuller details. After referring to the unfortunately too general ignorance on the subject prevailing amongst farmers, Mr Fyfe draws attention to the evidence which so many fields of wheat show as to the carelessness with which the seeds have been selected, bringing about a general discrepancy of result; and in place of having the produce of one particular kind—a condition, as Mr Fyfe remarks, "essential to good cropping and uniform ripening and growth"—the seeds are chosen, or rather, to speak correctly, taken indiscriminately without choice, so intermixed in variety, that the "stalks of some overtop the others, and many of the grains drop dead-ripe out of the ears before the rest are ready for cutting down." The farmer, he justly remarks, cannot control the seasons, but by choosing his seed-wheat with care he may modify them to a very considerable extent in his favour. With the deeper cultivation of our soils, secured by improved and powerful mechanism, it is probable that if better results are not attained in a degree easily marked by common observation, still we may predicate with safety, that a condition of matters will be brought about more favourable than hitherto to the cultivation of the finer and more productive grains. Seeing that this will be one of the good results of an improved system of culture, the importance, as Mr Fyfe remarks, of being able to discriminate between one kind of grain and another is obvious enough. Taking the number of wheats cultivated generally at the present time at fifty, "nevertheless minute marks appertaining to particular grains" must be registered and borne in mind by experts in examining them. "The mere size, shape, or colour afford no distinctive tests. One grain, however, has a central ridge which is characteristic, another is pointed to both ends, a third to the right, and a fourth to the wrong or life-bud extremity only; a fifth variety is marked by the prominence of these life-buds, a sixth possesses near the pointed end a peculiar wrinkle, whilst a seventh and an eighth

* The paper has, we believe, been reprinted and published as one of the Practical Papers for Farmers' Clubs. Groombridge and Son, London: 6d.

may be known by having this wrinkle more or less pronounced. These peculiarly distinctive marks are nevertheless only to be taken as such in the several classes of wheat to which they are specially appropriate, since accident or sport in vegetating may render them interchangeable in others also." Although the distinctive marks characterising different varieties of wheat are thus liable to change, still on the whole "means exist of sufficiently describing every variety of grains in cultivation," to attain which most desirable end Mr Fyfe suggests the use of the microscope, while prudently pointing out that "trial and experience will alone determine their suitability for any given soil, climate, or situation, for any established system of cultivation, or any new and experimental method of growth;" he says, and says truly, that "in the first instance it is surely of some moment to know what the seeds really are, and to make a study of their characteristics."

As regards the different varieties of seed-wheats little need here be given further than to glance at the names and leading peculiarities of those generally cultivated in this country, following here the classification and selection adopted in the paper from which we have quoted. Of the *white* wheats thirty varieties are named. These are Archer's prolific and Australian wheat—this last has created some attention amongst growers of late, in the hope that, maintaining its characteristics of early growth, "the period of our harvest might be altogether accelerated." This in some trials of it has been realised, Mr Fyfe mentioning an instance where it ripened a *month* before the usual time; in other trials the hope has, however, not been realised. In some, indeed, of which we ourselves have been cognisant, the percentage of ruined or non-germinated seeds was alarmingly large; and it does not follow that because a wheat may possess characteristics favourable to early growth and prolific powers in one climate, it will show these in another. Resuming our list of white wheats, we note first the improved Berkshire, possessing some of the characteristics of Archer's prolific, already noticed. Brittany or Breedar. Brodie's, much esteemed in the Lowlands of Scotland for "the beauty of its sample" and the earliness of its ripening. Brown-strawed Scotch Cheedham or Chedham, also known as Pearl white. Chevalier; under this name several varieties are included—the ten-rowed variety yields a heavy produce, the grain being thin-skinned, straw of medium length. Cluster wheat, first introduced under the name of Dudney; there are two varieties, the "dwarf" and "tall." Dantzie wheats are referred to by Mr Fyfe as having been found "to be not at all adapted to our climate;" and, further, the experience obtained by growing them here is corroborative of the opinion held by "almost all our advanced practical men," that the practice is not a good one which proceeds upon the assumption or theory that the development of the grain is favoured by a change

of seed from "a later to a more forward climate." In introducing these wheats, brown, red, and white, the hope was entertained that the "habit of late maturity" acquired by them in cold countries would be found capable of change by their transference to our climate. "Duck's-bill yellow" wheat was introduced into Jersey by Colonel Le Coteur from Kiel, on the Baltic; the young plants are very hardy, the ears "singularly compact," the grain plump and of a light yellow colour, yet easily shaken out, and yielding an inferior flour. "Essex white" is held in high estimation by millers from the fine quality of flour it yields; the straw is about 4 feet 6 inches in length, not apt to lodge, and yielding fine handsome ears, with a transparent thin-skinned grain. "Eltham," known also as "Whitworth," in the county of Durham and the northern wheat districts of England, where it is in great repute for spring sowing, and for its early ripening. "Eclipse," although a favourite in the south of England, was not successfully introduced into Scotland, alteration in the quality of the sample being the result of the change from a superior to an inferior climate. "Fenton's," "Hunter's," "Hopetoun," and "Mungoswells," are all allied Scotch wheats, enjoying a high reputation in certain districts. Of the straw of these, Fenton's is the shortest, being 4 feet 1 inch; Hunter's 4 feet 5 inches; Mungoswell's 4 feet 5 inches; and Hopetoun, the longest, 4 feet 7 inches. Of these, Mungoswells is chiefly used in East Lothian, the place of its introduction, the introducer being the well-known authority in cereals, Mr Patrick Sheriff. "Essex rough chaff," although much grown, is "subject to blight in unfavourable summers." It is esteemed by the London millers from yielding "a fine white flour with little bran." "Grace's" wheat, in its general characteristics resembles Hunter's wheat; much grown in certain districts of England; it is "considered too delicate for the climate of Scotland." "Kent white," is both hardy and prolific; it is extensively grown in England. "The Red-chaffed wheat" is in high favour with many farmers, the quality being fine, giving a weight of from 62 to 64 lb. per bushel. "Red-strawed white" is suitable for both winter and spring sowing, an early ripener, and gives an average yield of from 63 to 68 lb. per bushel. "Talavera," the prime favourite, says Mr Fyfe, "for quality in the wheat crop;" it can be sown at a later period of the season than any of the common wheats. "Taunton Dean," a favourite in Suffolk, where it "yields heavy crops of a mellow sulphur-coloured elongated grain, tapering towards both ends, inserted in long and compact ears, with straw of moderate height and stiffness." Another wheat greatly cultivated in the south of England, with a variety of names, is "Trump or Trumpeter's wheat." Under the name of "Hardcastle," a stiff-strawed variety, it is grown extensively, and considered the "best and most fruitful of the whites." The grain is thin-skinned, and averages from 63 to 66 lb. per bushel. "Uxbridge" yields wheat

the great favourite of the London millers ; "it is everywhere prolific, and its grain, though somewhat small and short, is plump and white, forming an elegant sample. Uxbridge is well worthy the attention of the cultivators of fine wheat." "Whittington," Wellington, or Eleys wheat was introduced from Switzerland by Mr Whittington of Ripley, who recommended it for "thin and inferior soils ;" it is not adapted for rich and heavy soils, the straw being in these apt to lodge on it ; is long and soft. It is in some districts considered valuable for spring sowing as it ripens early.

Of the red wheats, Mr Fyfe names twenty varieties : "blood-red" is the variety commonly cultivated in the west of England, although "it is by no means a model product of the red-wheat. "Browicks" has the reputation of being the best ; it is highly thought of by millers, who habitually use it for mixing with white wheat flour. The "bearded or April red" enjoys a good reputation as a profitable crop ; indeed, bearded wheats are gradually rising in estimation, and they seem especially adapted to fickle and stormy climates. The "beard" has many useful qualities ; it prevents the grain from being knocked up in windy weather, acting like a spring or a "buffer" when the ears are forcibly driven in contact by the wind ; the elasticity of the beard is also useful in preventing the ears lying too closely together when in the sheaf, so that a free circulation of the air between them is maintained. Of the red wheats, "nursery" is held in high estimation by millers, "who value this wheat alone equally with our best white, since its seeds, which are small, long, and slender, with a bright shining skin, yield flour of the best quality. It is distinguished by having an ear with *white* chaff and straw of the medium length, and its popularity is no marvel when the mere weight and bulk of its produce is taken into account ; the ordinary yield of nursery wheat weighs $66\frac{1}{2}$ lb. per bushel, and counts twelve sacks per acre." The "red lammas" is the most esteemed of the red wheats in Scotland. The "kessingland," a prolific red wheat, is thought by Mr Fyfe to be the progenitor of the "giant pedigree" and "nursery prodigy of the day." For notices of the characteristics of other red wheats as Spalding's prolific, Piper's thickset, Kent red, Hallett's pedigree nursery, golden drop, giant, Essex, or golden red, Dunstable, cluster red, conservative, Biddle's imperial, and Britannia, we refer the reader to Mr Fyfe's paper.

The subject of the "change of seed wheat" has been much discussed of late ; this, like other "vexed questions" of agriculture, is marked by the contrariety of opinions brought forward by those who ought to be authorities. Generally, however, a "change of seed" is considered a desirable point to be attended to ; so much indeed is this view held by some, that they change their seed every year. The subject, says a writer in the 'Mark Lane Express,' is one which deserves "full discussion." He says,—

"The points I wish more particularly to have cleared up are—1st, the nature of the change, *i.e.*, the kind of wheat; 2d, the best change, and the best kinds of wheat for different soils; 3d, the best change of climate, *i.e.*, from a warm to a cold district, *vice versa*; 4th, the best change from different soils, *i.e.*, from clay to chalk, or peat to loam or sandy, or to gravelly soils, or *vice versa* in each case respectively, or whatever changes may have been found desirable from soil to soil in any case.

"A friend of the writer occupies a farm in Bedfordshire, and another in Lincolnshire marshes. His custom relative to his seed-corn is to change it from one farm to the other annually; and he assures me he does it with great benefit in both cases, one of the proofs being, and that under repeated trials, and upon both farms, he finds that in competition with other kinds of seed-wheat the importations in both cases ripened earlier by about ten days than those varieties grown for comparison. The Bedfordshire farm is a retentive clay, the marsh farm a thin loam, upon a silty or sea-sand sub-soil. This is a fact worth knowing, and I trust my readers will give us many such, and also many other useful facts tending to elucidate this subject.

"At the risk of being thought presumptuous I will offer my advice. Every farmer should regulate his course in these matters according to his best judgment and experience. The varieties of wheat are very numerous; he best knows what sorts have proved well under his culture; these he should adhere to rather tenaciously, but with occasional deviations, or by introductions of new sorts, if well recommended. He should always change his seed; but he must be very careful that the seed is clean, and from a favourable district or climate; this he soon ascertains, either by his own experience, or on the information of others. The great thing is, that he takes care to do it. Depend upon it, that if this change be judiciously effected, it will amply repay the little additional cost. My opinion inclines most to a change from either a chalky, gravelly, or peaty soil, to a good loam, or a clayey loam, or heavy clay, and *vice versa*; also a change from a warm or a dry climate or soil, to a cold or a wet climate or soil; and I should demur as to taking seed-corn from a cold or wet climate at all. I should also recommend sowing the best and heaviest grain, and not to drill in more than from six to nine pecks per acre, always taking into consideration the fertility of the soil and the order of seeding."

In connection with the raising of seed for the direct purposes of the farm, it is worth noticing here the advantages which would accrue from the habit of a close observation of each field of wheat when near its period of ripening, with a view to the selecting and saving of those ears which, from their size or the beauty of their sample, afford a marked contrast to the general average of ear in the same field. We have never yet walked carefully along the side of a field of wheat—and it is generally towards the outer lines, where the grain is exposed to light and air, that attention should first be paid—but we have seen ears which in value far surpassed others by which they were surrounded. There can be no doubt that if this careful supervision of our wheat-fields were given each season, not only would the best samples of any given or recognised variety, but samples of new varieties would be obtained. The marking of these would be a work doubtless of some trouble, and so also would be their gathering and the placing of them in proper packets or bags; but in one sense it may be said that business is a trouble, and yet no man thinks of neglecting his business because it is so. In

gathering the selected ears a careful description of their peculiarities should be drawn out and kept for after-reference, along with one or more of the ears. The ears selected for the purpose of raising produce in the following season should be carefully cleaned and laid aside till the period of sowing. A plot of land should then be selected and laid out in subdivisions, and one or more of these allotted to the sowing of one particular variety. It will add much to the value of the experiments, and greatly, we may here remark, to the pleasure of the experimenter, if he will keep an accurate record of the "behaviour," as engineers say, of the produce of each plot—the dates of sowing, of brairding, blooming, and ripening. While writing these remarks on a subject in which we are specially interested, and in the carrying out of experiments in connection with which we have derived much pleasure, we have come across a few remarks in a contemporary journal bearing so closely upon the subject that we shall do our readers good service in making of them another "retrospective note." The article is one on the propagation of hardy and prolific varieties of our cereals; and in pointing out how this may best be done, the writer has the following:—"But there are limits to the beneficial influences of such improvements; and the ascertained produce of the present year's crop will, in most cases, force more strongly upon the attention of authorities that it is very important to select varieties which are comparatively highly productive even in adverse seasons. Some misapprehension exists as to the influence of improvements. A dry soil is necessarily of a higher temperature than one which is wet, and consequently is better adapted for the growth of the more tender kinds of the cultivated plants, more particularly of wheat. Still the temperature of the atmosphere and the amount of sunshine are very important conditions for the healthy growth of all the corn crops; and too much stress should not be put upon the counteracting influences of drainage, deep stirring, and high cultivation, in adapting land for the cultivation of the more tender kinds of cereals. The grower of corn requires to study to obtain a superiority of produce so as to acquire a high average return during the period of occupancy; and as inclement seasons occur at longer or shorter intervals, it is the more necessary to grow hardy and productive varieties, as well as to render the soil suitable for the healthy growth of those kinds selected. The combining of these conditions will usually secure success." We have already pointed out how the experiments connected with the raising of good samples or of new varieties should be carried out; and we have here to add to our notes on this head one from the article above alluded to, having reference to the produce of the experimental plots. It should be carefully seen that the character of the produce agrees with the one which was originally recorded, "as it is quite probable that a new kind has been produced accidentally—what vegetable physiologists term 'sporting.'" It is

right also here to remind the experimenter of what the writer of the above article has so judiciously drawn attention to—namely, that all the experiments will not be alike or at all successful; but “if success crowns one selection out of ten, the raiser of a new and superior variety will generally reap some pecuniary benefit, while his name will be recorded as the propagator of a hardy and productive variety.” We conclude this paper by heartily coinciding with the writer of the article in his opinion that agricultural societies have made a mistake in confining their attention exclusively to the encouragement of superior breeds of animals, and in neglecting the encouragement of the raising of new varieties of the vegetable produce of the farm, on the successful and productive raising of which, the existence of the animals so much depends. B.

THE FARMERS' NOTE-BOOK.—No. LXXX.

Effects of Extra Manuring upon Turnips. By Mr HENRY STEPHENS.—As a supplement to the paper on the effects of extra manuring upon turnips, which appeared in the January 1864 Number of this Journal, we give the results of certain experiments made by Mr George Bell of Inchmichael in 1863 at our request, with the same sort of specific manures and swedes as he used in 1862. The season of 1862 having proved so very unfavourable to the growth of turnips, as was evidenced in their results by the experiments of Mr Bell, detailed in January Number, p. 201, it seemed to us expedient for him to repeat the experiments in 1863, in the hope that that year would prove more favourable for the turnip, and that better results would be obtained.

It may be remembered that the best result obtained by Mr Bell in 1862 was 26 tons 15 cwt. per Scotch acre of Skirving's improved swedes, with 20 tons of farm dung and 8 cwt. of Peruvian guano. The second best result was, 25 tons 5 cwt. of swedes, with 20 tons of farm dung and 8 cwt. of superphosphate. And the smallest result was 23 tons 5 cwt. of swedes, with 20 tons of farm dung and 10 cwt. of Peruvian guano and 10 cwt. of superphosphate. The largest manuring returning the smallest crop in an unfavourable year.

In 1863 the swedes were sown on black land that had been three years in pasture, and then under a crop of oats, potatoes well dunged, and wheat without manure—all full crops. Weather and soil were in the most favourable state for the sowing and growth of the turnip. No farm dung was used. The specific manures employed were

Peruvian guano and superphosphate. The swedes were removed somewhat early in order to allow the land to be sown with wheat by the last week of December.

As a means of comparison in common with all the lots, one lot received no manure of any kind, and it yielded 28 tons of Skirving's swedes from the Scotch acre. The second lot had 5 cwt. of Peruvian guano and of superphosphate, and yielded 36 tons. The third had 8 cwt. of each of the manures, and yielded 40 tons, and this quantity corresponded with the rest of the field. Another lot had 15 cwt. of the two, and yielded also 40 tons; whilst the last lot with 20 cwt. of the two yielded only 38½ tons, but in this case the leaves were much stronger than in the others. Even in a favourable year the largest manuring returned the next smallest crop. Mr Bell is of the opinion that had 10 or 12 tons of farm dung been added to each lot, greater yields might probably have been obtained, but as the land was in good order, and the weather favourable, he, for the first time, tried the light manures by themselves.

On strong secondary *end* clay, heavily dunged, and assisted by 5 cwt. of Peruvian guano, the yield of Fosterton hybrids was 36 tons, and of Tweeddale purple-top yellow, 38 tons, rooted and shawed, per Scotch acre, and both were a very full crop.

It is unnecessary to repeat the estimates of the value of the yields given above, as was done with those of 1862, as detailed at p. 201 of the January Number. The cost of the manure in 1863 may be taken at £12 per ton for the Peruvian guano, and £8 for the superphosphate. In regard to the market-value of turnips, it has been remarked by a favourable critic of our former paper in the 'Scottish Farmer' that 15s. per ton for swedes and 5s. for white turnips indicate too great a disparity in value between these two classes of turnips. This may be, and it may seem to most farmers a great exaggeration to estimate swedes at three times the value of white turnips. We can only say that the disparity was greater in our younger days in Berwickshire, when swedes were estimated at 20s. the ton, while the white turnips were only 5s.; but then swedes were not nearly so extensively cultivated as they are now, and that was the reason we fixed the price at the reduced value of 15s.; and, on the other hand, white turnips are now, most probably, less cultivated. The intrinsic value of each kind of turnip should of course be valued as it is sold in its particular locality. As regards the quality of the white turnip, we do not think that a better kind than the old "globe" has yet been discovered—the pure white, and the green top globe, both perfect in symmetry.

This leads us to express a strong desire that farmers should institute satisfactory experiments on the comparative feeding powers of white turnips and swedes. The experiments would require to be made on beasts fresh from grass in October, and to terminate in January; for after the new year white turnips lose much of their

good qualities. We have always believed that sheep attain greater weight in proportion than oxen on white turnips. This comparative result between sheep and cattle would also constitute an interesting set of experiments.

We shall now offer a few remarks on the above results; and the first noticeable thing is the large yield of 28 tons of swedes per Scotch acre without any manure. It seems an exertion throughout the country to obtain 20 tons of swedes per Scotch acre, with the assistance of a considerable quantity of manure, whether of farmyard or specific, or of both combined. Such a yield is an unmistakable testimony of the great natural fertility of the soil of the Carse of Gowrie, as also of the high condition in which Mr Bell maintains that fertility.

2. And yet the weather has a decided influence upon the products of even the most fertile soils. On the same kind of soil Mr Bell only received 23 tons 5 cwt. of swedes per Scotch acre in 1862, after an expenditure of 20 tons of farm dung and 10 cwt. of Peruvian guano and 10 cwt. of superphosphate, at a cost of £16, 10s., and with a less weight in the crop by 4 tons 15 cwt., besides the disappointment of doubtless an inferior quality in the lesser crop. Such a prodigious disparity in results even in different years seems almost incredible. How is it that bad weather inflicts such a loss on the farmer? Obviously, it interferes with the usual preparation of the soil. It throws the sowing and management of the crop out of its proper season. It renders the manures less suited for the support of vegetation. And it so affects the separate parts of the plants themselves as to paralyse their functions. A combination of such direful influences cannot but have a deteriorating effect upon so delicate an organisation as a plant.

3. But even the same *good* weather, as judged of by our own senses, may have an unfavourable influence upon the same sort of crop in different seasons. Thus, in 1863, Mr Bell obtained only 38½ tons of swedes on the Scotch acre with the same quantity of light manures as Mr Hope of Nether Mains of Pitfour in 1861 received 52 tons—namely, 10 cwt. of Peruvian guano and 10 cwt. superphosphate, upon the same kind of black land, in the same district of the Carse of Gowrie. Different influences must have affected the plants in these two seasons, though both seasons seemed favourable for the growth of the turnip. We believe that in our climate the state of the atmosphere in regard to temperature and humidity affects vegetation for evil much more powerfully in the night time than in the day. Were the climate of the night with us as favourable for vegetation as it is in more southern latitudes, our productions would be immensely increased. The day temperature seems in most seasons quite satisfactory.

4. Another result deserves attention. In 1863, the lesser quantity of 8 cwt. of Peruvian guano and of superphosphate produced

Mr Bell 40 tons of swedes on the Scotch acre ; whereas 10 cwt. of each produced only 38½ tons. The natural conclusion arrived at by contemplating such a result would be as expressed by Mr Bell himself, when he says, "It thus appears that even in a favourable season for turnips, a medium quantity of these forcing manures, besides being most economical, will produce the greatest weight of roots." But has not the weather, even in the most favourable season for turnips, some influence, else how did the 10 cwt. of Peruvian guano and of superphosphate produce Mr Hope, in similar circumstances of soil and district, 52 tons of swedes? It is certain that the weather encourages the consumption of manures by plants to a greater degree in one year than another; but under what circumstances? It would be interesting to ascertain the circumstances by observation. Are the circumstances most affected by temperature, humidity, or sunshine?

5. It is undisputed that 1861 was a most favourable year for turnips, and it is equally indisputable that 1863 was a most favourable one for cereals. The increase of both sorts of crops may perhaps be taken at from 25 to 30 per cent. This being the case, it would be a most desirable piece of information to farmers to be made acquainted with the peculiar conditions of the atmosphere in regard to temperature, humidity, and sunshine which produced the best results for turnips in the one year, and for the cereals in the other. The conditions which most favour the growth of the turnip are warmth at the sowing, moisture and warmth at the brairding, heat for singling and hoeing, and then moisture and heat alternately for the growth, until the period of maturity. Those for the cereals are coolness at sowing, moisture and warmth at brairding, moisture and heat for growth, and heat for maturity.

We have no doubt but that the Meteorological Society possesses data, furnished by their numerous observers scattered over the face of the country, that could explain to us the peculiar conditions of these two seasons, which so palpably affected the growth of the turnip in the one, and that of the cereals in the other. Such an inquiry would be a useful piece of work for the indefatigable and accurate Secretary of the Society to undertake and to publish in their Journal for the benefit of farmers.

6. From the experience of the last three years on the effects of extra manuring upon turnips, we are entitled to conclude that the expenditure will remunerate the farmer. It will pay him in even the most unfavourable year for turnips, such as 1862 was, and we can hardly anticipate a worse. Mr Bell was left a balance of 18s. 7d. per Scotch acre in his favour—a very small sum no doubt, but still appreciable, and a source of thankfulness that no loss was incurred; and the yield after all was larger than is usual. It will pay him in the most favourable year, as 1861 was, as large a sum as £28, 10s. per Scotch acre; and we cannot expect to have such another very favourable year

for turnips for many years to come. Indeed, we do not remember such another season since 1815, not only for turnips, but for every species of crop. That year produced the combined effects of 1861 and 1863. Such a lapse between successful years is not incredible, as on the Rhine a fine vintage did not occur from 1811 to 1857. We would therefore urge upon farmers to be very liberal in manures to their turnips after being assured by the above results. We are aware that farmers consider they treat the turnip crop very liberally; but they are too apt to believe that if they expend more manures than amount to a certain cost per acre, the crop will not pay. Let us assure them that this is not correct reasoning; it is only the assertion of a foregone conclusion, based upon an assumption or an apprehension, and not upon experience. How can farmers possibly know what results will be when they do not, nay will not, try the experiment of extra manuring—meaning by extra manuring a quantity of manure much greater than what is usually given to the turnip crop. We confess we have looked upon many a field of turnips with sorrow at their woebegone condition. We have imagined they said to us, “Pray, do not look upon our condition with contempt. We assure you we cannot help it. We are half starved. Were we to get every day as much good food as we could consume, we should show you a lustiness even in an unfavourable season; and in a favourable one we should make the heart of the farmer to rejoice at our united bulk and quality.” This mode of reasoning is quite just; for nothing can be more absurd than to supply food to any crop merely in accordance with its pecuniary value, as then the higher the value the less food should be administered. This is not the principle upon which animals are treated. Their food is not doled out to them according to the value of a given quantity. The rational plan now pursued is to give every animal as much food as it can eat, from the day it is born to the day it is disposed of in maturity; and we all know that, unless this liberal plan is pursued, there is no chance of quick returns and remunerative profits from marketable stock. At all events, if advantage is not derived from pursuing a liberal system, it will not be attained by an opposite one. Why, then, should plants be treated on a different principle from animals, when both are creatures of life, and when plants are more sensibly affected by atmospheric changes than animals are, and when their very existence depends upon the vicissitudes of the weather? So reasonable an appeal for food ought to put the most economical farmer to his wits’ end. He may reply in answer, “It is all very well to talk in this confidential manner on results obtained from the finest land in Scotland. We have a very inferior description of soil to deal with, and our experience does not warrant us to undertake expensive experiments upon chance.” The answer is, “No doubt *your* experience constrains you; but how do you know what results

will be when you have not tried the experiment? You are influenced by a foregone conclusion as to expense. As to inferior soils, could any one undertake the cultivation of worse land than the Marquess of Tweeddale did on his farms of Yester?" And yet we see that in 1861 a profit of £9, 2s. per Scotch acre was obtained by extra manuring from yellow turnips, and in 1863 a profit of £4, 2s. 11d. on the white greystone turnip (*January Number*, pp. 200 and 201). Besides it should be remembered that inferior soils require the most and best manures. No doubt a maximum amount of manuring for turnips may be attained on every class of soils, and no doubt also the maximum may be attained sooner on one class of soils than on another. Mr Bell has proved to himself that 8 cwt. of Peruvian guano and of superphosphate per acre yielded a heavier crop of swedes than did 10 cwt. of those manures, both in a good and in a bad season. He would not be justified in employing 10 cwt. again upon his land; but, on the other hand, Mr Hope obtained the greatest crop by far with 10 cwt. of these manures, so he would be justified in employing *more* until he reached the *maximum*. Here is a plain rule for the farmer to follow, and he who follows it is so far safe, that he cannot go wrong beyond the experimental period.

AGRICULTURAL SUMMARY FOR THE QUARTER.

THE hopes of high prices which were excited in the minds of farmers in this country by the breaking out of the Dano-German war were very speedily doomed to disappointment, for soon after it commenced wheat dropped down even lower than it had been before. The demand at home became less active, and the supplies from abroad, notwithstanding the very full harvest of last year, continued to pour in in quantities almost as large as at the beginning of last year. The cause of these large importations was no doubt, in great measure, owing to foreign dealers being anxious to quit before a blockade prevented them from doing so, and they were inclined to submit to considerable sacrifice on this side the water rather than run the risk of having their stores choked full at home. The suspension of hostilities and the sitting of the Conference had the effect of encouraging a little speculation, but it was very trifling, and the fluctuations in prices from week to week were, generally speaking, of little moment. Indeed, it is quite clear that now, whatever wars disturb the world, so long as there is peace at home, the price of cereals will be but little affected. Our money will always command all markets so long as we remain neutral.

The breaking-up of the Conference without doing more than the famous King of France did in that metrical march with his men, and the not very great improbability that the country may demand that Great Britain, having exhausted all placable means, should at last vindicate the majesty of international law by the sword, has stimulated purchases in the wheat market, and wheat during the fourth week in June may be said to have risen from 6d. to 1s. per quarter, and the tone is firm. Should we really go to war, we may very soon expect to see wheat up at least 50 per cent; and if the whole of Europe gets complicated in the struggle, it can hardly fail to be double the present price in a very short time. Meanwhile cattle have for the last few weeks scarcely maintained their former rates, and have been rather heavier to sell at a slightly reduced figure. During the whole of the year, however, they have been paying remarkably well, even when bought in at a high price as stores. Sheep have also made capital returns, and wool has been paying beyond all precedent. Indeed, it may be said that, for the last two or three years, what the arable farmer has been losing the sheep farmer has been gaining.

The spring opened unpropitious for farming operations. March was a cold, wet, ungenial month; and, up to the second week in April, the weather continued cold, wet, frosty, and disagreeable, interfering greatly with field-work, and retarding the growth of the grass, thus entailing considerable additional expense upon farmers, feeding sheep, in the way of corn and cake. After this, however, the weather underwent a perfect and a pleasant change. Dry days and genial sunshine, accompanied with slight frosts, which caused but little injury to braird or blossom, characterised the end of April, and May up to the third week. In this interval farm labour was hurried rapidly on: the seed was committed to the earth under the most favourable circumstances; and potato and turnip land was wrought to perfection. About the 18th of May we had some of the hottest weather that has been experienced in that month for a long series of years. Indeed, unaccompanied with rain, it was just too hot, as it scorched up the young braird of the turnip, and gave encouragement to the ravages of the fly, which so devastated the fields in some districts, that they had all to be re-sown. The cereals were also somewhat checked in their growth, and the grass burned up. After this we had a succession of thunderstorms, attended with heavy showers, which the ground drank greedily up, and young plants began to push forward vigorously. Unfortunately the nights were frosty, and did much harm to the turnips and potatoes, and caused the cereals to assume a yellow and sickly hue. The two last nights of May were intensely frosty for the time of year; the ice being three-eighths of an inch thick in some localities. This frost, as might have been expected, played havoc with the potatoes, and many beautiful fields intended for the early market were cut down

to the ground. All other plants suffered in greater or less proportion, but the potatoes most. The weather, into the second week of June, continued showery and cold, but since then it has been highly favourable to the growing crops, which may be said, on the whole, to be all looking well in the best-farmed districts. In some of the poorer soils, and where it is manifest from the uncleanly state of the land that there is a lack of capital, so much cannot be said for them. Grass will be a thin crop, as the rain came too late to be of much service to it. The cereals will be later than usual; and it is the general opinion that wheat will be short in the straw, and perhaps in some parts a lightish crop; but oats and barley promise well.

The Law of Hypothec and Cattle Diseases.—The two great topics of conversation among agriculturists in Scotland since the publication of our March number, have been the Law of Hypothec and the Cattle Diseases Prevention Bills, now under consideration of a Select Committee of the House of Commons. The law of hypothec we had to notice in our last Summary, but since that time many influential meetings against it have been held; and there have been several cases before the public equally or more glaring than the one of *Graham Barns v. Allan*, which may be said to have originated the present movement for the abolition or modification of the law. The Marquis of Ailsa has, it is stated, come into court as pursuer in a case which has less of justice in it than even the request that a merchant should pay his goods twice, once to the tenant and then again to the landlord. His lordship has a rather high rented farm in Ayrshire, whose tenant has struggled hard to pay his rent for the last twelve or fourteen years, and has managed to do so until recently. On to this farm a neighbouring farmer, unknowing of the difficulties into which the tenant of the Marquis of Ailsa had got, sent some seventy sheep to winter. Five weeks after the sheep were put upon the farm the effects of the tenant were sequestrated, and upon the same day the owner of the sheep sold them, without knowing of the sequestration, to a butcher in Ayr, who immediately removed them; whereupon the Marquis of Ailsa puts in a claim for the whole price of the sheep. There is, we believe, no allegation that there was any collusion in the matter between the bankrupt tenant and the owner of the sheep, who is quite willing to pay for the grass eaten upon the farm, but who naturally refuses to sacrifice his stock to the landlord on no better ground than that they happened to be eating foggage on his farm when the occupier failed. What the law may decide in the case we know not; but every one must hold the opinion that it would be gross injustice, under such circumstances, to compel the owner to surrender his sheep. If it does so, it will work considerable mischief to Ayrshire farmers, many of whom are in the habit of letting their grass for wintering sheep, not only because it brings in money, but also because, if the sheep are well fed, such practice tends materially

to benefit the pastures. It is all very well to say that those wintering stock should take the precaution to see the receipt for the rent before they place their cattle or sheep upon a farm. This is an argument that has been frequently used by persons arguing for the continuance of the law in its present form; and even the Lord Justice-General himself spoke in favour of this being done. But, apart from the fact that such a request would be one extremely unpleasant and invidious, there is the other more potent one that it would be quite absurd, compliance with it being impossible, even supposing the tenant asked did not feel inclined to resent it as an insult. It seems to be forgotten by those who recommend the sight of receipts as a safeguard against the harsh operation of the law of hypothec, that farms in Scotland are not *forerented*, but *backrented* to the extent of a year or a year and a half, and in some cases for a longer period; the production of a receipt, therefore, would be no safeguard whatever to those having dealings with tenants. It would simply prove that the tenant had paid his last half-year's rent, but there would still be the other year or more unpaid, over which the landlord holds unusual preferential claims. In fact, the receipt, so far as security to the manure, seed, or cattle merchant is concerned, would be worth no more than its weight in waste paper. Another case, still more monstrous, comes from the same quarter; for Ayrshire seems determined to make itself notorious in connection with the law of hypothec. The facts here are so strange that they can scarcely be credited, but we quote them as given in an agricultural journal which had, no doubt, good authority for them:—

"The case," says our contemporary, "as we have been informed, stands thus: Some three years ago a respectable farmer took an upland farm, the grass portion of which he stocked with cows, cropping the remainder after the ordinary rotation. He has now found out that cows in that region do not pay; and seeing the high prices which beef, mutton, and wool have been bringing in the markets, he resolved to eat his grass with young cattle and sheep. Accordingly, he purchased a full supply of stock to take the place of his cows, which he advertised for sale; but the factor no sooner saw the announcement than he applied for an interdict against it, obtained it, and put it into force on the eve of the sale, notwithstanding that the tenant's agent offered to pay the current rent, and to find undoubted security for that of the following year. The tenant, so far as we can learn, was under no obligation whatever by his lease to keep cows; and supposing they had been sold, as advertised, there was enough left on the farm to satisfy the landlord's claims.

"Perhaps," adds our contemporary, "some of our legal correspondents would kindly answer three queries which the case suggests. Did the sheriff act rightly in giving the factor interim interdict in such circumstances? If a tenant's creditors, on giving security to the landlord for the rent, can rouse his stock, may not the tenant himself, on giving full security, sell a *portion* of his own stock? And have the creditors rights which are not permitted to the tenant?"

There can be no doubt at all that such cases, brought up by up-

holders of the law, are more likely to effect an alteration in it than the most eloquent speeches in favour of its abolition. But for the fact that landlords, as a rule, have never sought to stretch the law to those oppressive limits to which some are now wishing to extend it, the law must have been amended long ago, for all must admit that it embodies grievous anomalies; and it is injudicious in those who wish to retain it to excite public indignation by exhibiting it in its worst colours.

As we mentioned in our last Summary, the meetings in favour of amending the law have not been got up with any intention of stirring up ill feeling between landlord and tenant, but rather with the view of cementing their relationships. They have been attended by tenants of the highest respectability, who are on the best of possible terms with their landlords; and landlords are glad to make speeches in favour of modification, even of abolition, and to serve on the working committees for bringing about the desired end. The most important meetings that have been held on the subject during the quarter were those at Haddington and Edinburgh. At the former, Mr Harper, Snadon, made a temperate and most effective speech in favour of alteration. The Edinburgh meeting was presided over by the Lord Provost, and embraced representatives of all classes interested in the matter—landlords, tenants, manure-merchants, seedsmen, corn-factors, &c. The paper read by Mr Hope, Fentonbarns, was an exhaustive and telling one, and the other speakers showed good cause why the law should be amended. As indicating the spirit of this the most influential demonstration that has yet taken place, we quote the resolutions agreed on:—

“1st, That the law of hypothec, in its present shape, is of an unjust and anomalous character, and in the opinion of this meeting ought to be abolished, or so modified as to suit the requirements of the age; for although it may have been just and necessary at a time when the proprietor owned both land and stocking, the present altered position of farmers requires a law very different in its provisions, inasmuch as it is believed that the farmers in the Lothians alone spend little short of half a million yearly on manures, feeding stuffs, seeds, &c. (about as much as the rental of the cultivated lands in these three counties.) It is therefore unfair that the proprietor, who has only one year's *interest* of his capital at stake, should have such a preference over the merchant who risks his entire capital.

“2d, That, as it secures landlords and those acting under them against risk of loss, even when they let farms to those who have no other recommendation than that of being the highest offerers, it is injurious to agriculturists of character, capital, and skill, and highly prejudicial to the interests of merchants and traders, who judge mainly of the respectability and standing of the tenant by the position given him by the landlord who intrusts him with his farm; and, in particular, the law is harsh and oppressive, and at variance with the spirit of the times, in so far as it gives power to landlords to follow and bring back, or compel the repetition of the price of grain and other commodities purchased otherwise than in a stock market, although paid for at the current rate; and also because it enables the proprietor to take out a private sequestration, which he can put into force at

any time, to the great disadvantage and loss of all other creditors of the farmer.

"3d. That the possession of such undue privileges as the present law of hypothec confers on landlords over other classes tends to mar that harmony of feeling that ought to exist between proprietor, farmer, and agricultural trader, and is calculated ultimately to damage the best interests of the proprietors themselves.

— "4th, A Royal Commission having been granted, that this meeting petition for a full and complete inquiry into the whole working of the law of hypothec, and that a committee be appointed to collect evidence to submit to that Commission, and to take such other steps as they may deem necessary to secure the objects of the previous resolutions."

Although the names of the Royal Commission have not yet been made public, we believe that they are such as will satisfy all that the inquiry will be undertaken in a fair and impartial manner. Before quitting this topic, it may be mentioned, that, as we indicated in our last Number as not unlikely to happen, the judges have decided that the finding of the jury in the case of *Graham Barns v. Allan* was contrary to law, and the motion for a new trial has been granted.

Even more than the law of hypothec, perhaps, have the bills for the prevention of diseases among cattle, and to amend the law relating to the importation of diseased cattle and unwholesome meat, excited the interest of farmers and cattle-dealers, not only in Scotland, but, as the bills are general, over the whole of the United Kingdom. The provisions of the bills are so well known to all who take an interest in the matter, and consequently to all readers of this Journal, that it would be waste of space, as well as of the reader's patience, to go over the clauses *seriatim*. It is sufficient to say that the clauses which were most obnoxious were, the one in the former bill which laid an embargo upon the carrying of cattle supposed to be affected by disease by sea, while no such restriction was imposed upon railways—the latter thus virtually getting a monopoly of the traffic; and in the other bill the introduction of the foot-and-mouth disease into the schedule, the vesting of railway porters with authority to refuse any animals which they might consider diseased, the imposition of a penalty for offering such animals for transit, and an official inspection of stock at such great fairs as the Falkirk Tryst; and also the exaction of a penalty for driving animals suffering from disease along any public road, and the compulsion of disinfecting every part over which diseased stock passed. No one can dispute that there is every year a very considerable loss occasioned to stockholders by foot-and-mouth disease, or murrain. It is perfectly true that this disease rarely or never proves fatal; but cattle taking it go backward, and their keep for a month or six weeks is often altogether lost. If the aggregate loss over the whole country in this way was calculated for a year, the sum total would, we believe, startle most people. If it could be

prevented, it would be of great importance to the agricultural public, and through them to the community at large. But how is it to be prevented? If there was any practical method of doing so, we have no doubt that farmers would very gladly do all in their power to carry it out. It is quite true that they now make up their minds to suffer so much from murrain; but it is equally true that they would all prefer to pocket what they lose, if they could see the way to it. Murrain is a disease of a particularly infectious character, and comes so suddenly that it cannot well be guarded against. Sheep leaving the north perfectly healthy for the Falkirk Tryst, for instance, are seized by the murrain before they arrive at their destination. What's to be done with them? The owner himself well knows that they are diseased. The fact is patent to everybody who knows anything of sheep; but if they are offered for sale, according to this bill, the owner "shall be liable, in respect of every such offence, to a penalty not exceeding twenty pounds; and any Justice of the Peace may, upon the application of any constable, or of any owner of cattle, or his servant, make an order directing any constable to remove any diseased cattle to a place where they can be safely kept, without risk of affecting other cattle; and all expenses incurred in the removal may be recovered from the owner in a summary manner." Now, apart from the extremely harsh and arbitrary power with which the bill proposes to invest a Justice of the Peace, on the complaint, it may be, of a rival dealer's servant, it does not appear possible to carry out the orders under the provisions of this bill. At Falkirk Tryst there is no available place to keep a thousand or a couple of thousand sheep and a herd or two of cattle; and in driving them away to a distance, they must necessarily travel them along those very roads upon which they are prohibited to enter, leaving disease in their track, and seriously deteriorating the animals themselves. Then, again, any inspection that could be made at Falkirk Tryst or Hallow Fair must be of an exceedingly superficial, unsatisfactory, and unjust character. It would take a whole army of inspectors merely to glance, in the most casual way, at the masses of cattle and sheep collected together on these stances. The Select Committee of the House of Commons sitting upon these bills saw the absurdity and danger of allowing this disease to remain in the schedule before they proceeded far with their hearing of evidence, and have intimated that they will strike it out. With regard to pleuro-pneumonia—a very fatal disease—it seems quite necessary to take some action. The comparatively few numbers of cattle which are affected with this terrible complaint renders inspection a much more easy matter. And it might not be difficult to arrange that no animals suffering with pleuro-pneumonia should be permitted, under heavy penalties, to be exhibited in a store-market along with store-cattle, which, contracting the disease there, might carry it over the length

and breadth of the land, and spread disease and death amid many herds. It has not at all been proved that there is any danger attending the consumption of fat animals affected with pleuro, if they are killed as soon as the disease is noticed, and the diseased portions—the lungs—thrown away. Indeed, we have heard of cases where animals dying from pleuro after having been buried by the farmer have been dug up again and eaten by his hinds without the men suffering in the slightest therefrom. And in many cases farmers use in their own families the meat of animals which they have slaughtered on account of the appearance of pleuro. We would not, therefore, exclude beasts labouring under pleuro-pneumonia from fat markets, from whence they were to be transferred at once to the slaughter-house; but we would have them set in a place apart by themselves, and far removed from the proximity of store-cattle. And it would also only be fair to the public to give them the option of choosing or rejecting such food. The evidence upon which these bills have been founded has been much canvassed before the Committee. It is alleged, on one hand, that the statistics furnished by the Government Commissioner in his report are exaggerated and unfounded; and, on the other, that they fall far short of the real state of matters, and are perfectly capable of proof. Our own opinion, founded upon personal knowledge and the statements of others who can well be relied upon, is, that the truth, as usual, lies between the two parties. There is not so much disease, generally speaking, as the one side would make it appear, and there is more than the other side publicly admits. The witnesses, indeed, appear to have all too much of a personal bias in the matter; it is the good of particular interests rather than the general good which is sought to be obtained. Another thing in connection with the evidence which can hardly have failed to strike an unbiassed reader is, that there has been a considerable amount of misstatement somewhere, and a few of the Edinburgh dairymen do not seem to come well out of the affair. However, it is to be hoped that the Committee will be able either to reconcile contradictories, or to eliminate the chaff from the wheat.

Servants' Hiring Bill.—While upon Parliamentary questions we may notice the ill-advised attempt of Mr Dunlop to reduce the term of service of ploughmen and other farm-servants to one month instead of six or twelve, as at present. All engagements for a longer time were to be committed to writing—a species of handiwork which scarcely any farmer and no servant likes to perform, except upon compulsion. Mr Dunlop's motive for seeking to alter a method of hiring which has prevailed for generations, is understood to be one of the best; but unfortunately the excellence of an intention is no proof of the wisdom of its intender, or of its suitability or worth when carried out. Mr Dunlop, it is believed, sought by this means to strike a left-handed blow at the feeing fairs, which have

so often been condemned in this Journal; but his measure, if carried into law, would have produced results much more deplorable than even the orgies of a hiring market. The great complaint among farmers in most districts is, that their servants leave them too often; Mr Dunlop's bill would give them a facility for change which they have never before possessed. But it is not alone that it would cause servants to change oftener, which is an evil, but it would enable them to change at times that would not only be inconvenient but almost ruinous for farmers. Under such an arrangement as Mr Dunlop proposes, the servants might leave in a body in the midst of the very busiest season of sowing or of harvest; and as labourers are now very scarce in the rural districts, their loss would be most disastrous. For the hinds themselves, also, the change would be far from an improvement, as they might be compelled to leave their houses at a time when they could find no other dwelling in the locality; and wandering about shelterless in mid-winter, which would be the season that the master could most conveniently dispense with a man against whom he entertained a grudge, would be pitiful and comfortless without measure. Again, ere Mr Dunlop's motion could be made practical, an entire revision of the method of payment would require to be made. The oats, the barley, the beans, the wheat, the potato land, and the cow's milk, which form the emoluments of the hinds in East Lothian; the money, the meal, potatoes, and the milk, which are the wages of the Fife and Forfar ploughmen; the money, the meal, the cow's grass, peats, and potatoes, which are paid in Aberdeenshire—would all have to be commuted to the current coin of the realm,—the immemorial habits of the children of the soil altered entirely before monthly engagements could be entered upon among farm-servants. This portion of the bill Mr Dunlop has withdrawn, but with the intimation that he will reintroduce it next year. We trust before that time he will take into consideration the difficulties in the way of carrying it out; and if he does so calmly, we doubt not he will abandon his proposal altogether rather than court failure again.

Chamber of Agriculture and Scottish Farmers' Club.—We are glad to state that the project of establishing an institution of this nature in Scotland has now been fairly launched, and with, we are given to understand, good hopes of success. A prospectus has been issued to the following effect:—

"At a meeting of farmers and others interested in agriculture held in Edinburgh on 16th March 1864, it was considered desirable that a Chamber of Agriculture and Scottish Farmers' Club should be established in Edinburgh, and a committee was appointed to draw up rules and regulations for the management of such an association.

"The objects of the association are—to watch over the interests of practical agriculture; to promote the advancement of agriculture by the discussion of subjects connected with it; to consider questions that may be introduced into Parliament connected with agriculture; to afford frequent oppor-

tunities for social intercourse to farmers and others interested in agriculture from different parts of the country.

"Though the association is chiefly intended for farmers and others interested in agricultural pursuits, any person shall have a right to become a member of the association on being nominated and balloted for according to the rules of the association.

"The entrance-fee shall be one guinea, and the annual subscription one guinea.

"Though it would be desirable to have a club-house in which the meetings of the Chamber of Agriculture could be held, and the members could meet when in town, it is thought advisable merely to engage, for the convenience of members in the mean time, a certain number of rooms in a hotel in some central situation.

"All who shall signify their intention of joining previous to 1st October next, shall become members without being subjected to the operation of the ballot."

The provisional committee is an influential one, and, better still, one that is likely to work, as the names of Mr Hope, Fentonbarns, Convener, and Mr McLagan of Pumphreston, as interim Secretary, are of themselves sufficient testimony.

Agricultural Statistics.—This long-vexed subject has again been up before the House of Commons, and Mr Caird has succeeded in carrying against the Government a resolution to the effect that the collection and early publication of agricultural statistics would be highly advantageous to the public interest. What good will come out of this general sentiment we know not. It is one in effect similar to several others that have previously been registered upon the House of Commons books, and all as yet to no purpose at all. In accepting this, the House committed itself to no definite plan, and it is the method which has all along proved the barrier in the way of obtaining the desired figures. Mr Caird did indeed come forward with a proposal of his own, but Parliament did not sanction it, and it would have been unwise to do so, for accuracy cannot be secured in the manner Mr Caird suggests.

"His plan is to divide the land in England into ten, and in Scotland into five classes, according to the quality of the soil, nature of the climate, &c. These classes would be typical of all the cultivated land in Great Britain, which Mr Caird estimates at 15,000,000 acres, and each type it is suggested should be 100,000 acres in extent, the aggregate of all thus being 1,500,000, or a tenth part of the whole. Having obtained the produce of the 100,000 acres in each class, multiplication by ten would give the total for the entire kingdom. The types Mr Caird would have laid down on the Ordnance maps, and he would intrust the engineer corps to collect the returns. As soon as the season was far enough advanced—say in June—they would, with their Ordnance maps in their hands, mark down the kind of crop growing on each field, until every field in each typical district was exhausted. The contents of each field being known, it would be a simple matter of tabulation to bring out in various columns the total acreage of each crop. The result in each year might be published by the 15th July, and the variation in the extent under each crop be known before harvest. This would complete the first part of the inquiry, and would at once afford an accurate basis to all engaged in the trade for estimating the probable produce of the next

harvest. In the last week of September, inquiries in each typical district might be made as to the yield; and the result, applied to the acreage previously obtained, might be published early in October."

Such a scheme, involving so much estimation as to soil and climate, and so much multiplication afterwards, could not at the best be any more than an approximation, and it would be no use spending national money on what the agricultural journals already supply.

Highland and Agricultural Society.—If one may judge from the list of new members read over at the half-yearly meeting on June 22d—upwards of 100 in number—this Society may be regarded as in a very flourishing condition, and, considering the wealth and population of the two countries, even more so as regards members than the sister society across the Tweed. Among the various subjects before the Society were the forthcoming Stirling show, the Cattle Diseases Prevention Bills, Agricultural Education, and the Servants' Hiring Bill. The Stirling show, we are glad to learn, promises to be one of the largest and most successful that has been held by the Society. When the preliminary arrangements were making, the agriculturists in the central districts entered into the matter with spirit, and they have gone on unflagging to the end. The entries of cattle are 386 to contrast with 245 at Kelso, the horses 158 as against 127, though at Kelso there were thorough-breds exhibited, a class which does not compete at Stirling. The sheep and swine are also more numerous than at Kelso, which, in so far as the first-mentioned class is concerned, is rather curious, Kelso being the great sheep district of Scotland. Of the Cattle Diseases Bills, and the Servants' Hiring Bills, we have spoken in a former part of the Summary. Whether much good will result from the discussion and resolution about agricultural education may be doubted. Resolutions embodying a general sentiment have, if we recollect rightly, been accepted by the Society more than once before, and the results are as yet *nil*. We agree very much with Mr Wilson, Edington Mains, and Mr Hope, Fentonbarns, that it would not only be injudicious, but comparatively valueless, for the purpose contemplated, to subsidise parish-school teachers to give a smattering of agricultural terms and phrases, the practical meaning of which they themselves do not understand, to their scholars. It would be a waste of the funds of the Society, and it would be an undue interference with the commercial principle for a wealthy society to give money to one private academy and not to another. And as the Society is composed of so many interests, the violation of the commercial principle which is held in such high estimation in this country, would probably lead to much dissension and dispute among the members. The interim report of the council does not commit the Society to any course. Its conclusions are—

"1. That the council and committee cannot recommend the Society to interpose for the purpose of introducing into parish or other elementary schools

the teaching of agriculture. 2. The council and committee are not satisfied that the same objections apply to the proposal encouraging, by prizes, the agricultural education of more advanced youths in provincial academies; but further information is required before the council and committee can come to any decision. The answers received from the head-masters are in some respects satisfactory, but no step can be taken till these gentlemen have been able to bring the subject under the consideration of their respective boards of management.

Mr Milne Home's motion was—

“That this meeting, recognising the expediency of extending the means of obtaining agricultural education in Scotland, and likewise the duty of the Highland Society to attempt something more than it has hitherto effected for that object, returns thanks to the directors for the interim report now presented by them, and reserves consideration of the questions raised in the report till the final report has been presented as promised by the directors.”

This motion was carried after the important clause, “and likewise the duty of the Highland Society to attempt something more than it has hitherto effected for that object,” had been deleted. There was some more “badgering” of Professor Anderson about the manure question, arising out of that unfortunate report of his regarding phospho-guano, but little practical good resulted from it; and it would be as well now to let the matter drop.

Farm Partnerships.—In the March number of the ‘Journal’ we referred to a paper on Commercial Principles Applied to Farming, which has since been printed in pamphlet form. The following extract from it is worth consideration :—

“I proceed with confidence to advocate *large farms*, as providing, under proper arrangements, what small farms cannot do—namely, the foundation for *division of labour, mechanical appliances, consolidation and increase of capital*, and for a profitable high-pressure rate of production.

“To bring about slowly, but effectually, this combination of advantages, there seems to me to be one simple recipe—*FARM PARTNERSHIPS*; and, as most necessary to effect this result—*systematic farm accounts*.

“My plan is this: Let two farmers join together, the one to look after the tillage, the other to take charge of the stock, and associate with them a third, making up sufficient capital to farm some 600 to 1000 acres, on the best system. The third may be a sleeping partner; or, say, the younger son of a country gentleman, to whom might be assigned the charge of the books, the superintendence of the machinery, or such other special branch of farm business as he may be capable of managing. From the overcrowded state of the professions, such an opening for the younger sons of country gentlemen, who might be averse to trade, would, I apprehend, be eagerly sought. I can hardly conceive a better position for a young man of good connection, than a partnership with one or two clever, respectable agriculturists in a large farm; and I can conceive no more advantageous mode than this by which a couple of wide-awake farmers may find scope for their energy, and utilise their experience and ability to the best advantage. Or, as I have said, the moneyed partner might be what is termed a sleeping partner; the division of profits being in proportion to the work done, or money supplied. To such a firm, of course, bookkeeping would be essential; and to a firm so constituted, I conceive no bank would refuse temporary accommodation for legitimate trade purposes.

"Although the amount of capital which agriculture is capable of profitably absorbing is something prodigious, amounting—with draining requirements, and permanent improvements, in addition to farmer's wants—to something like £500,000,000; yet the capability of the country to produce or supply it is not less prodigious. The amount of surplus profits or interest accruing, is generally estimated at £80,000,000 annually; while the power of commerce to create the representative of wealth is enormous. I estimate the profits of trade at £200,000,000 annually, representing a capital employed, or turned over, of some £2,000,000,000. Now if every one paid his accounts in three month bills instead of cash, or, at all events, if three months extra credit was generally taken over the ordinary period of payment, a sum of £500,000,000 would be at once available for the purposes of commerce.

"And this is regularly done to a greater or less extent when money is in demand; but such a result can only follow, or be supported, *on confidence*.

"Capital is as mobile and interpenetrating and follows as simple a law as water, in finding its level. The safest and most profitable business will always require, and will command, the largest share; and I may safely say that no business with these characteristics was ever crippled in its development and operations by the want of capital. It is only businesses that do not pay, and that are carried on in a way not commanding the confidence of the moneyed class, that are starved, and suffer. Once show that agriculture is fairly profitable, and establish a claim to confidence from its business-like organisation and management, and then, from a thousand minute and unsuspected sources, and in a thousand ways inscrutable or scarcely traceable, capital will find its way—like water into your deep drains—to fill the empty pockets of the farmers, and fructify their half-cultivated fields."

Farmers' Clubs and Societies.—During the quarter the various clubs and societies for discussion of practical and other questions affecting the agricultural interest have been pretty active; but none of the subjects discussed call for special remark. We may say, however, that it is quite manifest that these associations do an immense deal of good in their districts, and that the establishment of a strong central club, as proposed, in Edinburgh, which should embrace members from all counties, would still further tend to benefit farmers and to raise the standard of farming in Scotland.

*FIARS PRICES of the different COUNTIES of SCOTLAND, for Crop and
Year 1863, by the Imperial Measure.*

ABERDEEN.		BUTE.		ELGIN AND MORAY.	
	Imp. qr.		Imp. qr.		Imp. qr.
Wheat, without fodder	38/9	Wheat - - -	35/5	Wheat - - -	39/2
— with fodder	44/3	Barley - - -	24/7½	Barley - - -	27/6
— Red, without fod.	27/3	Bere - - -	20/3	Oats - - -	18/4
— with fodder	32/9	Oats - - -	18/8½	Rye - - -	23/7
Barley, without fodder	25/4	Pease and Beans -	32/9½	Pease and Beans -	32/7
— with fodder	30/10	Oatmeal, per 140 lb.	15/6	Oatmeal, per 112 lb.	11/10
Bere, First, without fodder	24/4				
— Second, without fod.	23/				
— with fodder	28/6				
Oats, Potato, without fod.	16/9				
— with fodder	22/9				
— Common, without fod.	15/9				
— with fodder	21/9				
Pease - - -	30/				
Beans - - -	30/				
Malt, duty included	55/10				
Oatmeal, per 140 lb.	13/3				
ARGYLL.		CAITHNESS.		FIFE.	
Wheat - - -	25/10	Barley - - -	22/6½	Wheat, White - -	34/3½
Barley - - -	25/	Bere - - -	22/11	— Red - - -	33/
Bere - - -	25/	Oats, Angus - -	16/0½	Barley - - -	26/11
Oats - - -	19/10	— Sandy - - -	16/	Bere - - -	23/2
Beans - - -	31/	Oatmeal, per 140 lb.	14/1½	Oats - - -	17/0½
Oatmeal, per 140 lb.	15/7½			Rye - - -	24/11½
AYR.		CLACKMANNAN.		Pease and Beans -	29/2½
Wheat - - -	34/10½	Wheat - - -	36/10½	Malt - - -	51/7
Barley - - -	28/9½	Barley, Karse - -	26/5	Oatmeal, per 112 lb.	11/3½
Bere - - -	28/	— Dryfield - -	25/3	— 280 lb.	28/3
Oats - - -	17/9½	Oats, Karse - -	20/5½		
Pease - - -	36/3½	— Dryfield - -	17/10½		
Beans - - -	15/7½	Pease and Beans -	28/5½		
Oatmeal, per 140 lb.	15/7½	Malt, duty included	57/1½		
BANFF.		Oatmeal, per 140 lb.	13/11½		
Wheat - - -	39/				
Barley, without fodder	25/11				
— with fodder	31/2				
Bere, without fodder	22/8				
— with fodder	27/11				
Oats, Potato, without fod.	17/10				
— with fodder	25/4				
— Common, without fod.	16/6				
— with fodder	24/				
Pease - - -	30/4				
Beans - - -	36/6				
Rye - - -	12/9½				
Oatmeal, per 140 lb.	12/9½				
BERWICK.		DUMBARTON.		FORFAR.	
Wheat - - -	37/7½	Wheat - - -	34/5	Wheat - - -	35/6
Barley, Merse - -	28/0½	Barley - - -	24/5	Barley - - -	24/7
— Lammermuir -	26/5½	Bere - - -	22/5	Bere - - -	23/2
Oats, Merse - -	20/7½	Oats - - -	18/5	Oats, Potato - -	17/8
— Lammermuir -	19/10½	Pease and Beans -	34/	— Common - - -	17/6
Pease - - -	34/0½	Oatmeal, per 140 lb.	15/7	Rye - - -	25/7
Oatmeal, per 140 lb.	17/6½			Pease and Beans -	26/6
		DUMFRIES.		Oatmeal, per 140 lb.	13/7
		Wheat - - -	40/8		
		Barley - - -	27/8		
		Bere - - -	19/2		
		Oats, Potato - -	18/8		
		— Common - - -	18/8		
		Rye - - -			
		Pease - - -			
		Beans - - -	41/4		
		Malt - - -	64/		
		Oatmeal, per 140 lb.	15/2½		
		EDINBURGH.		HADDINGTON.	
		Wheat, First - -	36/11	Wheat, First - -	42/6
		— Second - - -	34/	— Second - - -	40/1½
		Barley, First - -	28/8	— Third - - -	37/6
		— Second - - -	27/	Barley, First - -	35/0½
		— Third - - -	26/	— Second - - -	32/4½
		Oats, First - - -	21/1	— Third - - -	29/6½
		— Second - - -	18/6	Oats, First - - -	23/10
		Pease and Beans -	33/6	— Second - - -	21/11½
		Oatmeal, per 112 lb.	12/	— Third - - -	20/6½
		— 280 lb.	30/		
				INVERNESS.	
				Wheat, without fodder	36/2
				— with fodder	41/8
				Barley, without fodder	25/3
				— with fodder	29/9
				Bere, without fodder	23/3
				— with fodder -	27/9
				Oats, without fodder	17/6
				— with fodder -	24/
				— Black, without fodder	
				— with fodder	
				Rye, without fodder	
				— with fodder -	
				Pease, without fodder	29/6
				— with fodder -	36/
				Oatmeal, per 112 lb.	12/6½

FIARS PRICES—Continued.

KINCARDINE.

	Imp. qr.
Wheat, without fodder	34/10
Barley, with fodder	42/4
Barley, without fodder	24/4
— with fodder	29/4
Bere, without fodder	23/1 1/2
— with fodder	28/1 1/2
Oats, Potato, without fod.	17/5 1/2
— with fodder	23/11 1/2
— Common, without fod.	16/5 1/2
— with fod.	22/11 1/2
Pease, without fodder	27/0 1/2
— with fodder	34/6 1/2
Beans, without fodder	27/0 1/2
— with fodder	34/6 1/2
Rye, without fodder	24/
— with fodder	31/6
Oatmeal, per 140 lb.	13/7 1/2

KINROSS.

Wheat	30/9
Barley, First	23/2
Second	22/2
Bere	—
Oats, First	15/6
Second	14/
Pease	—
Oatmeal, per 280 lb.	25/6

KIRKCUDBRIGHT.

Wheat	40/8
Barley	28/10
Oats, Potato	19/2
Common	—
Oatmeal, per 140 lb.	14/7

LANARK.

Wheat, First	37/5 1/2
Second	34/3 1/2
Barley, First	25/5 1/2
Second	20/10
Third	—
Bere, First	30/6
Second	—
Oats, First	18/6 1/2
Second	16/9 1/2
Third	15/0 1/2
Beans, First	33/2 1/2
Second	—
Malt, duty included	—
Oatmeal, per 140 lb.	15/4

LINLITHGOW.

Wheat	36/4
Barley	28/2
Oats	18/9
Beans	31/11
Malt	50/10
Oatmeal, per 112 lb.	13/8
140 lb.	14/6

NAIN.

	Imp. qr.
Wheat	39/1
Barley, without fodder	25/10
— with fodder	31/
Oats, without fodder	17/0
— with fodder	24/6
Oatmeal, per 112 lb.	11/10

ORKNEY.

Bere, per 376 lb.	18/2
Malt, duty included	21/6
— (exclusive of duty)	12/4
Oats	—
Oatmeal, per 140 lb.	12/6

PEEBLES.

Wheat, First	—
Second	—
Third	—
Barley, First	27/10
Second	26/8 1/2
Third	25/2 1/2
Oats, First	19/5 1/2
Second	17/11 1/2
Third	16/6 1/2
Pease and Beans, First	—
Second	—
Third	—
Oatmeal, First, per 140 lb.	14/3 1/2
Second	14/2 1/2
Third	13/11 1/2

PERTH.

Wheat, First	36/2
Second	26/
Barley, First	25/4
Second	20/1
Oats, First	17/7
Second	13/8 1/2
Pease and Beans	29/7
Rye	25/
Malt	—
Oatmeal, per 140 lb.	14/4

RENFREW.

Wheat, First	36/11 1/2
Second	35/9
Barley, First	27/11 1/2
Second	26/9 1/2
Bere, First	25
Second	22/6
Oats, First	19/9 1/2
Second	19/
Beans, First	33/10
Second	32/7
Oatmeal, First, per 140 lb.	15/9
Second	15/8 1/2

ROSS AND CROMARTY.

	Imp. qr.
Wheat, First	36 3/4
Second	35 3/4
Barley	26 1/2
Bere	25 3/4
Oats, First	18/9
Second	17/9 1/2
Rye	—
Pease	39/0 1/2
Beans	36/
Malt	—
Oatmeal, per 140 lb.	14/10

ROXBURGH.

Wheat	38/6 1/2
Barley	27/2 1/2
Oats	20/11 1/2
Rye	—
Pease	36/
Beans	34/10 1/2
Oatmeal, per 140 lb.	14/4 1/2

SELKIRK.

Wheat	36/4
Barley	26/0 1/2
Oats, Potato	—
Common	18/1 1/2
Pease	35/7 1/2
Oatmeal, per 140 lb.	14/6

STIRLING.

Wheat	38/9
Barley, Kerse	26/4
Dryfield	25/7
Oats, Kerse	19/
Dryfield	18/1
Muirland	14/4
Pease and Beans	28/11
Malt	53/2
Oatmeal, per 140 lb.	14/8

SUTHERLAND.

Wheat	39/5
Barley	25/6
Bere	21/3
Oats	20/6
Rye	—
Pease	—
Oatmeal, per 140 lb.	16/8

WIGTOWN.

Wheat	35/8
Barley	29/6
Bere	27/
Oats, Potato	18/
Common	—
Rye	—
Pease	—
Beans	35/4
Malt	—
Oatmeal, per 140 lb.	29/9

WE may inform our English readers, that Fairs Prices are the average prices of grain, as ascertained every year, by the verdict of Juries, in every County of Scotland. The Juries are summoned in spring, and ascertain, from the evidence produced to them, the average prices of the preceding crop. By these prices, rent payable in grain, and similar contracts, are generally determined; but the main object is to convert into money the stipends (for the most part fixed at a certain quantity of grain) of the Scottish Clergy.

FOREIGN MARKETS.—PER IMPERIAL QUARTER, FREE ON BOARD.

Date.	Markets.	Wheat.		Barley.		Oats.		Rye.		Pense.		Beans.	
		s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
1864.													
Feb.	Danzig	21 0	25 6	14 6	18 0	11 6	14 0	17 0	21 6	24 0	28 0	25 0	29 0
March		20 6	25 6	15 6	19 6	11 6	14 0	17 6	22 0	24 6	28 6	25 6	30 0
April		20 0	25 0	15 0	19 0	11 0	13 6	18 0	23 0	24 0	28 0	25 0	29 0
May		20 0	25 0	16 0	20 0	11 0	13 6	17 6	22 6	23 6	27 6	24 6	28 6
Feb.	Hamburg	21 6	27 6	14 6	17 6	12 0	15 0	17 6	22 0	25 0	29 0	26 0	30 0
March		21 0	27 0	15 0	18 0	12 0	15 0	18 0	23 0	25 0	30 0	26 0	30 6
April		20 6	26 6	15 6	19 6	11 6	14 6	18 0	23 6	24 6	28 6	25 6	29 0
May		20 0	26 0	15 6	19 6	11 0	14 6	17 6	22 6	24 0	28 0	24 6	28 6
Feb.	Bremen	21 0	26 6	14 0	18 0	11 0	14 0	16 6	21 0	24 0	27 6	25 0	28 6
March		20 6	25 6	14 6	18 6	11 6	14 6	17 0	22 0	24 6	28 6	25 0	28 0
April		20 0	25 0	15 0	19 0	11 0	14 6	17 6	22 6	24 0	27 6	24 6	27 6
May		20 6	25 6	15 6	19 6	11 0	14 0	16 6	22 0	23 6	26 6	24 0	27 0
Feb.	Königsberg	21 6	27 6	14 6	18 6	11 6	14 6	17 0	22 0	25 0	28 6	26 0	29 6
March		21 0	27 0	15 0	19 6	11 6	14 6	17 6	22 6	25 6	29 6	26 0	29 0
April		21 0	27 0	15 6	19 6	11 0	14 0	18 0	23 0	24 6	28 6	25 6	28 6
May		20 6	26 6	15 0	18 6	11 0	14 0	17 6	22 0	24 0	28 0	25 0	28 0

Freights from the Baltic, from 5s. to 7s. 6d.; from the Mediterranean, from 10s. 6d. to 12s.; and by steamer from Hamburg, from 5s. to 6s. per imperial qr.

THE REVENUE.—FROM 1ST JANUARY 1864 TO 31ST MARCH 1864.

	Quarters ending March 31.		Increase.	Decrease.	Years ending March 31.		Increase.	Decrease.
	1863.	1864.			1863.	1864.		
	£	£			£	£		
Customs	5,772,000	5,533,000	..	239,000	24,034,000	23,232,000	..	802,000
Excise	4,665,000	5,127,000	462,000	..	17,165,000	18,207,000	1,052,000	..
Stamps	2,374,000	2,439,000	65,000	..	8,994,000	9,317,000	323,000	..
Taxes	357,000	367,000	10,000	..	3,160,000	3,218,000	68,000	..
Post-Office ..	955,000	965,000	10,000	..	3,650,000	3,810,000	160,000	..
Miscellaneous	1,250,746	1,390,089	139,343	..	3,058,561	3,340,963	282,402	..
Property-Tax	3,890,000	3,168,000	..	722,000	10,567,000	9,084,000	..	1,483,000
Total Income	19,263,746	18,989,089	274,657	961,000	70,608,561	70,208,963	399,598	2,285,000
Deduct increase .....	..	..	..	686,343	Deduct increase .....	..	..	1,890,402
Decrease on the qr. ...	..	..	..	274,657	Decrease on the year	..	..	394,598

PRICES OF BUTCHER-MEAT.—PER STONE OF 14 POUNDS.

Date.	LONDON.		LIVERPOOL.		NEWCASTLE.		EDINBURGH.		GLASGOW.	
	Beef.	Mutton.	Beef.	Mutton.	Beef.	Mutton.	Beef.	Mutton.	Beef.	Mutton.
1864.										
Feb.	7 6	8 9	8 9	10 3	7 9	8 9	8 0	10 0	7 6	8 8
March	7 3	8 9	8 9	10 3	7 6	8 8	8 0	10 0	7 9	8 9
April	7 3	8 6	8 9	10 3	7 6	8 8	8 0	10 0	7 9	8 8
May	7 0	8 0	8 9	10 3	7 6	8 8	8 0	10 0	7 9	8 8

PRICES OF ENGLISH AND SCOTCH WOOLS.—PER STONE OF 14 POUNDS.

ENGLISH.		s. d.	s. d.	SCOTCH.		s. d.	s. d.
Merino,	25 0 to 30 6	..	..	Leicester Hogg,	24 0	..	30 0
in grease,	20 0	..	26 0	.. Ewe and Hogg,	24 0	..	30 0
South-Down,	25 0	..	32 6	.. Cheviot, white,	22 0	..	27 0
Half-Bred,	20 0	..	26 0	.. laid, washed,	16 0	..	20 0
Leicester Hogg,	28 6	..	35 0	.. .. unwashed,	13 0	..	16 0
.. Ewe and Hogg,	25 0	..	30 0	.. Moor, white,	13 6	..	17 6
Locks,	12 6	..	15 6	.. laid, washed,	10 0	..	14 0
Moor,	9 6	..	13 6	.. .. unwashed, .....	..	..	11 8

**AVERAGE PRICE OF THE DIFFERENT KINDS OF GRAIN,
PER IMPERIAL QUARTER, SOLD AT THE FOLLOWING PLACES.**

LONDON.								EDINBURGH.							
Date.	Wheat.		Barley.	Oats.	Rye.	Pearse.	Beans.	Date.	Wheat.	Barley.	Oats.	Pearse.	Beans.		
1864.	s.	d.	s.	d.	s.	d.	s.	d.	1864.	s.	d.	s.	d.	s.	d.
Feb. 6.	43	2	38	10	17	9	29	0	33	9	33	8	32	3	8
13	43	10	34	3	20	5	29	1	33	7	33	7	33	2	2
20.	41	4	34	11	21	8	28	10	32	6	33	2	33	0	2
27.	43	9	35	6	19	9	30	0	32	4	33	1	33	0	2
Mar. 5.	43	3	28	7	21	6	28	6	32	10	33	5	33	5	5
12.	42	11	34	9	23	3	29	0	33	0	32	7	33	9	9
19.	42	6	34	8	19	5	32	4	32	10	32	10	32	6	2
26.	42	2	28	10	18	11	28	0	33	8	32	2	32	2	2
April 2.	43	5	34	0	18	10	28	5	32	11	32	6	32	8	8
9.	43	4	33	0	19	8	28	0	32	8	32	8	32	8	8
16.	42	7	36	0	18	6	27	8	31	11	33	0	32	0	0
23.	42	1	35	3	22	1	28	7	32	1	32	7	32	7	7
30.	41	5	32	9	22	3	28	7	32	1	33	9	32	9	9
May 7.	41	8	32	8	22	4	32	0	32	1	34	6	32	8	8
14.	41	10	33	5	22	11	28	5	32	6	34	0	32	6	6
21.	42	10	27	7	23	2	31	5	32	9	34	2	32	9	9
28.	42	1	31	10	21	1	27	7	31	9	34	6	32	9	9

LIVERPOOL.								DUBLIN.							
Date.	Wheat.		Barley.	Oats.	Rye.	Pearse.	Beans.	Date.	Wheat.	Barley.	Oats.	Pearse.	Flour		
	p. barl.	p. barl.	p. barl.	p. barl.	p. barl.	p. barl.	p. barl.		p. barl.	p. barl.	p. barl.	p. barl.	p. barl.		
	20 st.	16 st.	17 st.	14 st.	9 st.				20 st.	16 st.	17 st.	14 st.	9 st.		
1864.	s.	d.	s.	d.	s.	d.	s.	d.	1864.	s.	d.	s.	d.	s.	d.
Feb. 6.	38	7	30	6	23	0	28	10	32	8	33	6	18	6	6
13.	39	0	30	4	19	6	29	0	32	6	34	0	18	7	7
20.	39	6	30	0	17	10	28	6	33	2	33	9	18	7	7
27.	38	0	28	4	19	6	29	6	32	8	33	4	18	8	8
Mar. 5.	38	10	24	9	19	0	30	0	32	4	33	2	18	7	7
12.	38	10	28	10	19	0	29	4	31	8	33	0	18	8	8
19.	38	11	30	9	19	5	30	8	32	0	33	4	18	7	7
26.	38	3	29	9	19	6	31	2	32	8	33	6	18	7	7
April 2.	40	3	29	2	19	0	30	6	31	9	33	0	18	8	8
9.	40	0	28	6	17	10	29	8	31	4	32	10	18	7	7
16.	38	2	28	8	21	1	28	4	31	8	32	8	18	8	8
23.	38	2	28	7	24	2	29	1	32	2	33	0	18	9	9
30.	40	2	28	10	23	9	28	6	32	4	32	8	18	8	8
May 7.	37	9	29	2	19	9	28	2	31	9	32	4	18	7	7
14.	37	6	28	9	22	4	29	6	30	8	32	6	18	6	6
21.	38	8	28	6	24	5	30	4	31	6	33	2	18	6	6
28.	35	5	28	4	22	10	30	8	32	2	33	8	18	8	8

**TABLE SHOWING THE WEEKLY AVERAGE PRICE OF GRAIN,
Made up in terms of 7th and 8th Geo. IV., c. 58, and 9th and 10th Vict., c. 22. On and after 1st
February 1849, the Duty payable on FOREIGN CORN imported is 1s. per quarter, and on Flour
or Meal 4½d. for every cwt.**

Date.	Wheat.		Barley.		Oats.		Rye.		Pearse.		Beans.	
	Weekly Average.	Aggregate Average.	Weekly Average.	Aggregate Average.	Weekly Average.	Aggregate Average.	Weekly Average.	Aggregate Average.	Weekly Average.	Aggregate Average.	Weekly Average.	Aggregate Average.
1864.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
Feb. 6.	40 4	40 6	32 0	31 11	18 9	18 2	29 0	29 4	33 0	33 8	33 8	33 8
13.	40 8	40 8	31 11	32 0	19 1	18 10	29 1	29 3	33 7	33 8	33 7	33 6
20.	41 1	40 10	32 0	32 0	19 8	19 0	28 10	29 1	32 5	33 1	33 2	33 6
27.	40 6	40 9	32 0	32 1	19 4	19 1	29 0	30 11	32 9	33 0	33 1	33 5
March 5.	40 2	40 7	31 6	31 11	19 10	19 3	28 6	31 0	32 10	33 1	33 5	33 4
12.	40 1	40 6	31 5	31 10	19 8	19 6	29 2	30 7	33 0	32 8	32 7	33 3
19.	39 9	40 5	31 4	31 8	19 2	19 2	32 4	31 2	32 10	32 11	32 10	33 1
26.	39 11	40 3	30 10	31 6	19 0	19 5	28 0	31 0	33 3	32 10	32 8	32 11
April 2.	40 2	40 1	31 0	31 4	19 2	19 4	28 5	30 11	32 11	32 11	32 6	32 10
9.	40 1	40 0	30 9	31 2	18 11	19 4	29 0	29 8	32 8	32 11	32 8	32 9
16.	40 1	40 0	30 10	31 0	19 3	19 2	27 8	29 1	31 11	32 9	33 0	32 9
23.	39 7	39 11	31 1	31 1	19 0	19 0	29 0	29 1	32 7	32 1	32 7	32 8
30.	39 2	39 10	30 6	30 10	19 4	19 3	28 7	28 5	32 1	32 7	33 9	32 10
May 7.	38 9	39 8	30 3	30 9	19 5	19 4	32 3	32 9	32 1	32 5	34 0	33 1
14.	39 3	39 6	29 9	30 6	19 8	19 5	28 5	29 2	32 6	32 4	34 3	33 5
21.	39 8	39 5	29 6	30 4	20 0	19 7	31 5	29 7	32 9	32 4	34 2	33 8
28.	39 5	39 4	29 0	30 0	19 10	19 8	27 7	29 7	31 9	32 4	34 6	33 11

CONTINENTAL RAMBLES BY ROAD AND RIVER.

No. II.

ENGLISH travellers proceeding direct to the German Spas have hitherto had two routes only open to them—namely, that by Brussels *via* Liege, Verviers, and Cologne; or from Rotterdam by rail or river to Cologne; from thence up the Rhine. A third, and in every respect the finest and most interesting route, has recently been added—namely, that by Namur and Luxembourg to Treves, thence down the Moselle, striking the Rhine at Coblenz, some three or four hours' sail farther up the Rhine than by the above routes. This new route presents to the delighted traveller a most remarkable variety of scenery all the way from Namur to Treves, and the sail down the Moselle is to our mind much finer than that of the Rhine. Taking Brussels as the starting-point for this new route, this fine city—the miniature Paris, as it has been justly called—may be reached, either by way of Calais, Ostend, or Antwerp: we suppose the reader to prefer the latter route.

The Continental tourist who passes through Antwerp should take the opportunity to ascend the spire of its grand old cathedral; that spire of which Charles XII. is reported to have said that it “should be kept within a glass-case.” Like all other exaggerated expressions, this contains a good sprinkling of truth; for the stone tracery which adorns the spire is certainly so beautiful, and in the pure air of the district looks so fresh, fair, and delicate, that a crystal covering seems by no means inapplicable to it. But apart from its beauty as a work of architectural design and execution, it possesses, or should possess, an attraction to the agricultural mind bent on receiving new and not altogether useless or unsuggestive inspirations; for in no part, perhaps, of Central Europe, and certainly in no part of this our tight little island, can a view be obtained so comprehensive as regards the extent of space comprised within it, and so agriculturally suggestive as regards the localities which that space embraces.

Standing in the centre of a vast plain, which, in remote ages, has doubtless been under water, the eye could, if eye was piercing enough, take in a huge circle, sweeping round fifty miles or more in all directions. On one side are the fertile fields of Flanders, which may well be called the nursery of modern agriculture, as from them Europe has received its most valuable crops, and the wisest counsel as how best to produce them. In contrast to the fair fields of this wonderfully rich tract of country, a turn of the spectator on his elevated view-point will bring into the range of his vision the “Desert of the Campine;” for so, with its vast tracts of sand, widespread marshes, quaking bog, and stunted heath, may it well be called. Farther on, in the direction of Brussels and Namur, is the entry to

the Ardennes, that region so dear to the English mind from the charm which the genius of our Shakespeare has thrown around it. This view-point afforded by the Cathedral tower of Antwerp may be called the centre of an agricultural district, possessing examples of the extremes of agricultural practice. On the one hand, a dense population inhabiting flat plains, garden-like in their fine culture, and, like gardens, wonderfully productive; on the other, a wild and barren district, with a sparse population painfully wresting, in the most rude and imperfect way, from an ungenial soil, the scantiest of crops. This part of Central Europe, then, may be said to comprise an epitome, so to speak, of all varieties of locality, and all varieties of farming, so that the traveller cannot traverse any district from which so much can be learned as to what should be done, and what should be avoided, as this which we have so briefly indicated. The lessons of what should be done, and how to do it, are perhaps more marked than those which show what should be avoided. For in no district of Europe—and in saying this we may say of the world—have we presented to us such remarkably successful instances of what patient and untiring industry can do in wresting from the most unpromising of materials such a wondrous wealth of produce. Inasmuch as whole tracts of the best cultivated districts, which afford beyond any shadow of doubt or cavil the finest evidences of farming which Europe can show, have been formerly simply sandy deserts, every inch of which has been raised from its normal sterility to its present condition of fecundity by the exercise of an industry of which, indeed, it is hard to say whether we admire it most for its far-seeing prudence, or for the patience with which its results have been produced. We know of no district where a farmer's holidays could be so profitably and so pleasantly spent as in the district we have indicated. Before asking the reader to accompany us through the interesting and little-known "Ardennes," we solicit him to follow us in a brief glance at the peculiarities of some of those views from the Cathedral spire of Antwerp. Looking down upon the "lazy Scheldt," thus well characterised by Goldsmith, the traveller can trace along its banks, otherwise tame and uninteresting, vast tracts of land smiling with the greenest of pastures and the richest of crops, which, by the patient industry of man, have been wrested from the flowing waters. Two hundred and fifty years ago, nearly the whole of the land thus bearing its herds of cattle, or its fields of waving grain, was submerged by the tidal waters; and it is difficult to estimate the severity of the labour by which it has been reclaimed. These reclaimed lands are called the polders, and are enclosed from the action of the tides by high mounds or embankments, called the digues, on the summit of which may here and there be seen huge windmills employed to pump the drainage waters of the enclosed lands, and deliver it to the river. As above hinted at, the formation of polder land is a work of time, the daily tides bringing up

a wonderfully rich deposit of animal and vegetable debris, a large proportion of the latter being brought down by the medium of drainage canals from the interior. All this is gradually and gently deposited till the level of the land is almost imperceptibly raised. The daily-coming tides form here and there islands, so to call them, which, gradually left unsubmerged, become covered with a coarse herbage on which a stray sheep or two are fed. As time passes the channels between these islands are choked up, and the little islands spread out into wider tracts, and bear richer vegetation. At this stage the district thus partially formed is enclosed by the embankments or digues, the expense of the construction of which is either wholly borne by Government, or by the proprietors, who either act individually or as companies, more or less numerous. To encourage these, the enclosed lands are held by them for a certain number of years at a merely nominal rent. As soon as the land is fairly enclosed, and the tidal action altogether ceases, it becomes covered with a crop of fine natural grass. This natural pasture is used for feeding sheep and cattle for some time, till the soil is deprived of a considerable portion of its saline matter, and is fitted to bear crops. The cereals for several years are remarkably productive, and a succession of crops, both cereal and green, are taken without any manuring, so rich is the soil in fertilising material; but this course of procedure gradually lessens the fertility of the polder land, and greatly changes its mechanical condition from a rich loamy to a heavy compact soil. The fallow is then introduced into the rotation, coming round every five, six, or seven years. A rotation often adopted is fallow first year, winter barley second year, beans third year, wheat fourth year, flax fifth, clover sixth, potatoes seventh year. The fine and careful farming of the celebrated districts of east and west Flanders is not met with in the polder lands; the inherent fertility of the soil, and which continues for several years unexhausted, inducing a careless mode of treatment. The great defect of the rotation adopted is the want of green crops; the result of which is a foul condition of land, and a lack of winter food for stock, which therefore returns to the spring pasture in a miserably low condition. Improved rotations are, however, gradually being introduced, so that in the course of a few years the exhaustive mode of farming now so generally witnessed in the polder districts may be numbered amongst the things that were.

Not far from Antwerp is the district of the Pay de Waes, celebrated for being the finest cultivated of all the finely cultivated districts of the Low Countries; it is here that the astonishing results of the small-holding system are best witnessed. Spade-culture is largely carried out, although not, as stated by some authorities, to the utter exclusion of the time-honoured plough, which, on the contrary, is used almost always, at least very frequently, in conjunction with the more simple implement named above. It is here that the

advantages of deep culture of the soil, and an unsparing lavish application of manure to it, which form two of the chief distinguishing features of Flemish farming, are, perhaps, best exemplified. The depth to which the soil is cultivated far exceeds that adopted in this country, approaching very nearly to a depth of 2 feet. The land is divided into narrow stretches or furrows, deep furrows being dug between them. The earth taken from these is thrown over the surface of the furrow, and it is taken only from one side of the ditch. The result of this is, that the position of the ditches is gradually changed, so that in process of time the land which at one period was dug into the form of a ditch forms at another part of the solid land bearing crops, so that the whole field is alternately ditches and furrows, and has consequently been *all* cultivated to a depth equal to that of the ditches. It is with a system like this, and on soils such as these, that steam-culture would receive its finest development; the fields, too, level as billiard-tables, are admirably adapted for the economical application of steam to the turning-over of the land. Manure, both liquid and solid, is thoroughly well understood in this rich district of Belgium; and should any one be desirous to see how it is saved and applied, let him by all means spend a few weeks in watching the doings of the Flemish farmers. Not very odorous, truly, will the perfumes be found which are wafted across the fields where the excreta of the towns and villages are being spread over their surface; but in watching the process a lesson will be learned as to the value of a manurial material which in this country of ours is strangely neglected, notwithstanding the issues of all the Government reports which have been printed from time to time showing forth the advantages of the *town sewerage* utilisation. Nor will the lesson thus derived be the less valuable if it exposes one fallacy which, persistently maintained by Government reporters, has done much, perhaps more than anything else, to indoctrinate the public mind in this country with false views as to the town-sewerage question, and correspondingly to postpone the realisation of all schemes for its utilisation. This fallacy is here worthy of being specially noted; and it is this: "If," say the eager advocates of town-sewerage utilisation, who, by some means, have got exclusively the ears of Sewage Commissioners, and the run of the pages of their reports—"if such astonishing results" (and that the results are astonishing, a walk through the Pay de Waes district will easily prove) "are obtained in Flanders by the application of liquid manure to all crops, what is the use of attempting to deny—as has been denied—that the same application will produce the same results in this country?" But the assumption is, that the liquid manure of Belgium is the same as the liquid sewage of our towns, an assumption altogether erroneous. If the reporters who so triumphantly cite the experience of Flemish farmers as supporting their views, had ever visited these same Flemish farmers, they would very soon have seen that the liquid manure used by them is

a vastly different compound from the liquid obtained from *our* sinks and sewers. The "liquid manure" of Flanders, in its richness, being composed almost exclusively of human and animal excreta, and frequently further enriched by oil-cake and ashes dissolved in and mixed with it, is the very opposite to the stuff obtained from our town sewers, of which a very large proportion indeed is water, which, while it adds to its bulk, takes away from it, to a large extent, its manurial richness. The official opinion, then, which we have above alluded to, is utterly unsound and fallacious, and, calculated as it is to convey false impressions, will give rise to hopes which will be sure, by experience, to be blasted. We trust that its further exposition in the pages of the Government reports will cease: public honesty demands this. We offer no apology for thus deriving from foreign fields a lesson applicable to our own; comparative observations are always valuable.

We have alluded to the "Desert of the Campine." A run through this district will convey to the traveller many lessons of value. Nothing can exceed in interest the woeful sterility of the major portion of its sandy, heathy surface, except the tracts here and there met with, rich in their fertility, which owe their creation to the patient industry of the cultivator. Indeed, nothing but the exercise of the most untiring patience and struggling activity could suffice to bring the wastes of the Campine into cultivation. Literally the land is wrested from the enemy inch by inch. It is here that the difficulties caused by the growth of the heath (*Erica Brabantica*) are best exemplified. This heath has an astonishing vitality in it; it grows everywhere, alike in solid sand or spongy marsh. It is, indeed, often specially grown upon purely sandy soils, being the first crop taken from them in the process of their reclamation, its roots binding together and consolidating the loose particles, and the withered leaves serving to manure it. But in other places where the heath has had possession of the land for some years, the task of reclaiming the tracts of land upon which it grows is rendered very difficult from the pertinacity with which the spreading roots cling to the soil, and the vitality with which they are invested, so that, if left in the ground, vegetation at once recommences. The difficulties of reclamation are also increased when, as is too frequently the case, the soil immediately beneath the surface, and that at no great depth, unfortunately is a hard pan with much iron in its composition. Frequently, too, the subsoil is a stiff clay, but this is not altogether unfortunate, as this deposit is often used to dress the lighter lands; broken up and mixed with ashes, either coal or peat, the results of this top-dressing of light lands are very satisfactory. In reclaiming heath lands the upper surface is well broken up by the plough, so as to bring as much as possible the soil to the surface, there to be acted upon by atmospheric agencies. This is done early in the season, and in autumn the decaying roots and matter are

brought up by hand to the surface. Cropping now commences, and this usually with potatoes, followed by rye ; to which succeeds oats, with clover ; this followed with rye ; then oats, with artificial grasses.

The traveller transported to Namur, and standing on the ramparts of its fortress, celebrated in history, and one of the strongest on the Continent, will have a scene presented to his view the characteristics of which are the very opposite of those which attracted his attention when looking out from the tower of Antwerp Cathedral. In place of a flat and apparently boundless plain, the eye rests upon a country diversified with hill and dale, through which the lovely river Meuse winds its way, bordered by banks richly wooded and vine-clad, or by frowning cliffs and projecting rocks. Charmingly situated upon this river, Namur is a capital starting-point from which to commence the exploration of some of the finest, if not the finest, scenery to be met with in the run from Brussels to the Rhine. There are two routes open to the choice of the traveller—down the Meuse to Liege, and thence by way of Verviers to Cologne ; or through the Ardennes by way of Arlon, Luxembourg, Treves, and thence to Coblenz. Of these by far the finest is the latter, to which we shall presently return, briefly referring meanwhile to the first portion of the former of these two routes. In place of taking the railway from Namur to Liege—which, however, is a beautiful drive—we would strongly recommend the traveller to descend the river by the little but swift steamer, which makes the trip down in from four to five hours. We warrant him that he will not suffer in any way from the ghost of ennui—by which, by the way, all Continentals firmly believe that Englishmen are for ever haunted—that is, if he is imbued with a love for the beautiful in river scenery. Many parts of the river are surprisingly fine : not nearly so broad as the Rhine, the banks approach each other closely, and thus bring their beauties within the easy ken of the traveller. If time permits, let the traveller stay a night at the ancient town of Huy ; the town, in its architectural quaintness, is worthy of a brief inspection, and the walks in the neighbourhood are very lovely. While travelling down the river, we heard a venerable priest relate to a fellow-passenger a little jesting story connected with the town, which will bear repeating. The name of the town is pronounced like *oui* (yes), and it so happened that an English traveller from Liege to Namur, in his anxiety to know his arrival at the latter place, popped his head out of the carriage as it stopped at the station at Huy, demanding of the guard if it was Namur. “ *Oui, monsieur,*” was the reply—meaning that Huy (*Oui*) was the place, not Namur ; when, taking it for *yes*, out jumped the traveller, to find, on being left, that there were more *Oui*'s than one in his travelling vocabulary, of which he was ignorant. It reminded us of one of Hood's pleasantries—of which class, by the way, it is possibly an example—

where he makes a poor French traveller, entering the village or town of Ware, demand of a rough rustic Hodge—Be I at Ware? (where?) and receive with true English gruffness the somewhat bewildering reply, “Vell, I knows you be.” On approaching Liege, the extensive and very celebrated engineering works of Cockerill & Co. will be seen on the right side of the river. Liege is a large manufacturing town—the Birmingham or Sheffield of Belgium, and there is much to interest the traveller in its buildings; the environs are very beautiful. The railway ride from Liege to Verviers is, perhaps, one of the most beautiful on the Continent. The Agricultural Societies of Liege and Verviers are exceedingly well conducted; they have done good service in promoting sound agricultural practice; and the papers which they have published are amongst some of the best of the excellent papers produced in Belgium.

To return now to the route from Namur to Luxembourg: passing through the classic regions of the Ardennes, the traveller can proceed direct from Namur to Luxembourg by railway; but we should recommend him to take the steamer up to Dinant, a quaint old town, most beautifully situated. The sail up the Meuse to this point is even finer than that down from Namur to Liege, which, indeed, is saying a great deal. For a view rarely excelled in striking beauty, let the traveller ascend the heights behind Dinant; the best way, and by far the finest mode of ascent, is through the finely laid-out grounds of the Société of the town, corresponding to our club. We may remark, *en passant*, that Dinant is a capital central point for shooting and fishing excursions. Nor is it less so for those who take delight in romantic and striking scenery. This quaint old town, with its Turkish-looking church, abounds in rich historical associations. It has been subjected, in the wars which devastated the whole region in the middle ages, to the most revolting and barbarous measures. Philip, by some strange freak or in the bitter irony of the times surnamed “the Good,” besieged the place, took it, and, irritated by the refusal of the inhabitants to surrender it, gave it up to a three days’ plunder, and thereafter doomed it to ashes. So relentlessly was this carried out, that after the flames had subsided the ruins were searched, and all that had escaped from the first were subjected to a second burning. The town was rebuilt by the son of Philip, Charles the Bold, but was again taken and sacked by the French under the Duke de Nevers in 1554. Some idea may be formed of the barbarity even of the boasted knights of those days from the following:—Close upon the town is the Castle of Bouvignes, situated most commandingly on the crest of a high precipice. This was besieged by the Duke de Nevers, just named; and so fiercely was the siege carried on, that, in process of time, all left in the garrison were but three beautiful females; these, to save themselves from a fate worse than death, and which they knew too well awaited them, threw themselves from the ramparts right in the

midst of their savage assailants: their fate may be guessed at. While at Dinant, an excursion should be made to the grotto of Hans, a very singular natural curiosity. The cave, or grotto, is penetrable to a distance of nearly a mile and a half, and some of the halls or chambers are of amazing height.

From Dinant the railway *en route* to Luxembourg and Treves may be joined by taking a conveyance to Ciney, at which place there is a station. From Ciney the train proceeds to Jemelle, the station for Rochfort, which is about a mile distant. Rochfort is a romantic town, walled, and having a ruined castle, which was in 1792 the prison of the celebrated Lafayette, who was made prisoner by the Austrians and confined here. It is chiefly known now to tourists as the most central point for making the inspection of the Ardennes and sporting excursions, game abounding in the district surrounding. From Rochfort, or rather from Jemelle, its station, the railway passes through the valley of the river Homme—the scene of *our* Shakespeare's 'As you like it.' Nothing can surpass the contrast which this charming valley presents to the wild wastes and moorlands which make up the high land surrounding it. Soon after leaving Jemelle, St Hubert is reached, remarkable for some beautiful scenery, in the midst of which it lies, and as the site of the church dedicated to the patron saint of sportsmen (St Hubert). Arlon, the next principal station reached, is the capital of the Belgian province of Luxembourg; it presents nothing of interest to the tourist, and but little to the archæologist further than this, that it is supposed to be the Ordlanum of the Romans. Metz, on the Moselle, may be reached from here by diligence, and an excursion may be also made to Florenville, passing through the lovely valley of the Semoi.

The railway from Namur to Arlon passes through a remarkably romantic country; the character of the scenery is for ever changing, now opening out into wide expanses of heath-covered plains, dense forests, and gloomy hill-sides; now contracting into the most charming of valleys and the most pastoral of glades. It is indeed a land of agricultural contrasts, of which the extremes are met with in the open and confined spaces, those in the former being as remarkable for their sterility as those of the latter are for their smiling fertility. The climate is very variable, and the winters are long and severe; high winds sweep the plains, and snow-storms block up the valleys. Like the Campine, the Ardennes have for years been looked upon as the desert lands of Belgium. The soil, however sterile its scanty products may in many places show it to be, is not in reality so poor; it is indeed, if not above, at least not below, the average of richness in fertilising constituents. It is chiefly of a clayey sand, which seems well calculated to resist the two extremes of the climate, namely, heavy rains and exceeding heat. The depth of soil is considerable, it is easily worked, and the subsoil is fortunately good generally. The best evidence of the natural value of the soil is met with in

the astonishingly fine crops of rye which the land produces under the most reckless of rotations and the most careless of culture. The fallow plays an important part in the routine of the ordinary cultivation, but little care is taken to keep the land under it clean and free from weeds. The weeds and grasses are allowed to grow as they like ; nor need the fact be wondered at that the former luxuriate more than the latter. Pastures formed in this way are allowed to lie for years, cuttings of such hay as they can afford being taken at certain intervals. The mode of bringing this grass land under cropping is rude in the extreme. Manure is spread out on the surface in the early spring months, and, allowed to lie there all the summer months, it is ploughed in in such rough fashion as a clumsy plough, oxen-drawn, can secure, and the crop is generally abundant. On the rye being cut down nothing further is done with the land, but it is allowed to lie till spring, such a thing as autumn cultivation being in no wise thought of. The clumsy inefficient ploughing is again gone through, and a crop of oats taken. As in the case of the rye, so in that of the oat crop, no care is taken to keep the land clean—the crop has simply to take its chance. Potatoes are often taken the third year, manure being sometimes sparingly applied ; sometimes, perhaps most frequently, altogether omitted. After the potatoes a succession of crops of oats is taken, till the soil refuses longer to bear a crop which satisfies the not ambitious wishes of the farmer. But it is surprising how far this point extends, for it is no uncommon thing to find the sixth crop of oats yielding a high rate of produce. Such may be taken as a rapid review of what may be called the original mode of cultivating the Ardennes—a mode the results of which prove beyond a doubt the inherent value of the soil, and afford the most encouraging hopes of what may be borne by it under a more rational system. Nor, indeed, is it necessary for us to anticipate what the results of an improved mode of working may be, for fortunately, under the new regime or era of agricultural improvement, examples may not seldom reward research of well-cultivated farms bearing abundant crops of clover, of wheat, of roots, and grasses. But although improvements have of late years been made, and are in each successive year being still more extensively made, in the farming practice of the Ardennes, from what we have said of its peculiarities of soil and climate, the reader will easily understand how it is that as a rule no very remarkable instances of successful cultivation are to be met with. The general features of the farming of those picturesque districts may be witnessed on a not very close examination of the rotations adopted, the preparation of the soil, the care, treatment, and application of manures, and of the kinds of implements employed ; in all of these departments it is indeed by no means a difficult matter to see how deficient they are in the application to their defects of correct principles. If we examine, for instance, the rotation generally

adopted, we shall see in them examples of careless cultivation, which favour the growth of weeds and the rapid withdrawal of fertilising matter from the soil. We here give a few of the rotations of this class, the first being one extending over five, the two others extending over six, years.

I.

First year,	.	Rye, manured.
Second "	.	Oats.
Third "	.	Colza (oleaginous plant) or oats.
Fourth "	.	Oats.
Fifth "	.	Grass, which lies down for a period varying from 6 to 10 years.

II.

First year,	.	Rye, manured.
Second "	.	Oats.
Third "	.	Potatoes.
Fourth "	.	Oats.
Fifth "	.	Oats.
Sixth "	.	Grass for 6, 7, or 8 years.

III.

First year,	.	Rye, manured.
Second "	.	Oats.
Third "	.	Oats and potatoes.
Fourth "	.	Oats.
Fifth "	.	Colza or flax.
Sixth "	.	Grass as above.

The succession of exhausting cereal or seed crops, and the almost entire absence of green or fallow crops, are the observable features of these rotations, which are essentially opposed in principle to the system of alternating crops, in which white crops precede green crops, the period of the growth of the latter admitting of ample opportunities for hoeing, weeding, and stoning the soil. The following is an example of a much better rotation than any of the above :

First year,	.	Roots.
Second "	.	Oats or barley.
Third "	.	Clover.
Fourth "	.	Wheat.
Fifth "	.	Forage crop, consisting of colza, cut green, and given to the cattle.
Sixth "	.	Wheat.

Much has been done, and a vast deal will yet be done, in raising the fertility of the lands of the Ardennes, and of increasing the supplies of forage for cattle, and, by consequence, of manure for the other crops, by means of irrigation. It is by no means difficult to meet, in one's wandering through the districts of this interesting part of Belgium, with examples of *irrigation*, not always, however, well arranged or constructed on the best of principles ; there are, however, very fine examples to be met with on the lands of enterprising proprietors ; the most celebrated of these are to be met with near St Hubert, Houfflaise, Bastogne, and in the canton of Neufchateau. At a time when the question of irrigation bulks largely in the agricultural mind of this country, and when, indeed, the exigencies of

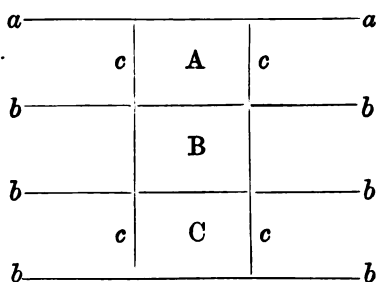
seasons remarkable for drought, such as the present, make its importance to be seen more strikingly than ever, it will not be useless to devote a few pages to an examination of the principles and practice of irrigation, as practised in several districts of the Continent, remarkable for its fine and successful examples of this department of farming economy. A good deal of the unfortunate results which sometimes meet the irrigator, and frequently give rise to opinions antagonistic to the value of the system, owe their origin to a neglect of the fact that the benefit of irrigation does not alone depend upon the application of the water simply to the soil, but upon the cultivation of the soil itself. It is essential, therefore, that a proper relation between them exists, so that the plants to be borne by it shall have a condition favourable to their development. The previous preparation of the soil is therefore essential, and first in the rank of the preparations to be proceeded with is the drainage. This may seem to be a very unnecessary proceeding where water is to be so plentifully supplied; but it should be remembered that a porosity of soil is essential to the growth of the plants, so that the atmospheric effects may exercise themselves upon their roots. Stagnant water, therefore, should never be permitted in the irrigated meadows; but while a gradual passage over the external surface is secured, an equally gradual, but not less certain infiltration of a portion of the water through the soil should not be neglected. It is indeed to the neglect of this that so much of the failure of irrigated land in the Ardennes is to be attributed. Although in many parts of the Ardennes examples of irrigated fields are met with, still it is to be regretted that a bad system of management is too often carried out; the water is supplied at all times in the extremes of weather and without any definite plan. The following may be taken as an example of good management for water meadows in this most interesting country. As soon as the last cutting of the season is taken, the duty of the farmer is to see to the rectification of the irrigated surfaces, and to that of the channels which supply them with water. This is essential, and it seems but a commonplace remark to make, that it is useless to make in the first instance with great care and at much expense all the irrigating channels, and then to allow them by neglect to get out of repair. After, then, all the channels are made perfect, the water may be let on, less judgment or care being required in the autumn months, as of October and November, than in those of spring and summer; the water may be allowed to pass on freely to the meadows. But as towards the middle or end of the latter month, frosts may come on, the greatest exercise of judgment is demanded from the irrigator, for on his proper management depends much of the future success of the season. Irrigation, properly managed in winter time, has the effect—and this is not very generally known—of saving the grass from much of the evil effects of extremely hard frosts. Hence, in a country like that of the Ardennes,

where the winter season is remarkably severe, the importance of attending to the winter management of the irrigated meadows. Wherever frost, then, appears, or is threatened, the water should not be let on over an irrigated surface. As a rule, when the water is passed on in winter, the quantity should be less than at other seasons ; when the surface of the grass begins to have a blackish or dark hue, the quantity of water supplied to it has been sufficient. When the frost has been very severe, so that the soil is hardened under its influence, or the surface covered with ice or snow, it is of importance to get rid of the effects of these by giving, on the near approach of milder weather in spring, by passing over them, large quantities of water, this being done of course as soon as the water flows freely in the channels. The experience of Continental irrigators is decided on this point—namely, that allowing the ice on the surface of the grass to be melted by the sun's heat, has a most prejudicial effect on the after-growth. In spring, the irrigation, as before stated, must be carried on with judgment, the feature of practice of this period being the passing on of the water at intervals, not continuously as in autumn. In mild weather irrigation is carried on every four days, and for a period of twenty-four hours. When frost takes place, the water should be let on at night, and taken off in the morning. If the month of April continues to be favourable, the water may be let on for three or four days in succession, thereafter withdrawing it for a period of twenty-four hours, thereafter commencing the irrigation ; if the nights are very cold, and frost likely to take place, the water should be allowed to flow over the surface all the night. Should a frost come suddenly on, and affect the surface when the water has been withdrawn, the water should be let on in the morning, and allowed to run till the surface is left pretty damp, after which it should be withdrawn for eight or ten hours. The condition of the atmosphere in the early spring months is that which should decide the degree of irrigation. If they are cold and liable to frost attacks, the quantity of water passed on to the surface should be large ; if mild, the reverse. In the months of June or July, should rain be frequent and abundant, the irrigation will require to be less ; and if dry, the water should be applied more abundantly. The irrigation should cease for at least ten days before the grass is cut, and for the same period after ; but if the weather is favourable, and a second crop required, the water may be applied during the night for seven or eight nights in succession, after which it is applied only three or four nights. In October, if the temperature maintains itself mild, the last cut may be taken, after which the autumnal labours begin, as already pointed out. It is worthy of note here, that as in other departments of agriculture, so in that of irrigation ; the rules given for one district must not be taken as strictly applicable to another or to all districts : every locality will, in fact, require its own peculiarities of management ; and the times of irrigation and the quantities of water supplied will

vary according to these peculiarities, be they of soil or climate. After irrigated meadows are carefully laid out, and the surfaces are well formed, the preparation of the surface for the sowing of the seed for grass is the next point to be attended to. In the Ardennes, burning the surface is often done, and much recommended by authorities. It gets rid of the bad plants, modifies the nature of the soil, and supplies it with fertilising materials. In some cases, a partial burning of the surface, followed by a rigorous harrowing, is found sufficient for a preparation of the land for the reception of the grass-seeds.

As we are upon the subject of irrigation, and as our notes like our rambles are discursive, and lay no claim to be considered as arranged systematically, it will be perhaps as well here to exhaust what we have to say upon it, and to take our readers for this purpose from the plains of the Campine, and the wild yet romantic districts of the Ardennes, to the banks of the classic Rhine, and see what the Germans do in utilising running streams, and fertilising their meadows and pasture-fields. In our last paper we drew pointed attention to the fact that irrigation was practised extensively in the Rhine districts, the tiniest rivulet which flows through their romantic valleys being used to irrigate such portions of land as may present facilities for the application of the water. These isolated, and, in consequence of the very hilly or pronounced character of the ground, not very frequently met with, examples of irrigation are, as may be supposed, arranged upon the simplest system. There is one district, however, near the Rhine, where irrigation is carried out not only on a most extensive but a complete and perfect scale,—this is the district known as the Siegenwald, and is reached, if not in the shortest way, yet by that which is the most romantic, by the traveller stopping at Königswerke, where, by the way, he may have an opportunity of seeing a magnificent view from the Drachenfels, and taking the road from thence to Altenkirchen, and from thence to Siegburg. The valley of the Sieg is exceedingly romantic, the character of much of its scenery in its wildness presenting a contrast to the richer valleys bordering the Rhine. It is here that irrigation is seen developed in a remarkable manner; for not only are the flat lands in the bottom, but those on the steep sides of the valley, and almost every available spot in the lateral glens, brought under the influence of the vivifying waters, which cover them with the richest and greenest of pastures and meadow-grass. Little is known of the early history of these meadows; that they originated at an early period in the history of the country is plain enough, for even in the sixteenth century laws existed relative to their organisation and the maintenance of the water-ways. It was not known till the middle of the eighteenth century that a systematic attempt was made to reduce the art to rules adapted to all localities; this being effected by a Herr Dresler

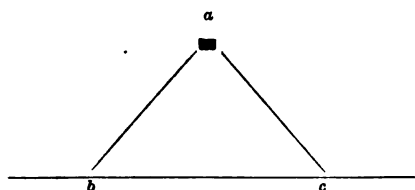
of Siegen. The science, so to call it, was still further indebted to a very eminent practitioner, Herr Frederick Vorlander, whose work on its principles and practice is now held as the authoritative one; and from which the following details have been culled. The degree of inclination, as well as the nature of the soil, regulates the mode by which it is irrigated. Where the inclination of the land is considerable, the land is laid out in beds with inclined surfaces; the channel of supply *a a*, varying in width from three to five feet, and with a depth of from two to three, is placed at the highest part of the land, and the distributing channels *b b* are



placed parallel to this. The water is not shed over the whole breadth of the spaces, as A B C, between the channels; but is led from one channel to another by cross channels, as *c c*, so that the water is partly shed over the surface, and is partly led by the cross drains *c c* to the distributing channels *b b*. The

dimensions of the terraces found best adapted to give the largest yield, are in the direction of length, as from *a a* to *b b*, 60 feet, and in the direction of breadth as from *c c* to *c c* 15 feet. It is a curious circumstance that the finest grass grows in the immediate neighbourhood of the distributing and cross channels. The levelling of the meadows is the first operation after the level of the main channel of supply has been decided upon. If the surface-sod is strong enough, it is cut up into narrow stripes, some 10 to 12 inches broad, 13 to 15 yards long, and 1 to 1½ inches thick; this operation is effected by a narrow spade; the marking or cutting of the surface being done by a peculiar-shaped axe, something like a Lochaber axe in the outline of its edge. As soon as the stripes are cut and pared off, they are rolled round a wooden stake into the form of drums, and carried away in order to cover the levelled surface of the terrace or beds. Where the surface sod is not of sufficient consistency to be operated upon in this manner, it is lifted up in spits and transported by wheelbarrow to where it is required. In levelling the soil thus deprived of its upper covering, the skill of the irrigator is displayed in adjusting the excess of the raised parts to fill up the deficiency of the depressed parts. But in doing this, the surface soil immediately beneath the sod is not removed, a depth of from 8 to 9 inches being retained in order to form the bed of the terraced beds on which the sod is relaid. The subsoil, therefore, is only used to fill up hollows, and to level the whole surface. If the inequalities of the ground are such in respect of elevation,

that there is a surplus of soil left over after filling up the hollows, it is carried away to a place of deposit, and serves to make a "compost," which is applied to the surface of other lands which may be deficient in fertilising value; this of course is only done when the subsoil is itself of a valuable nature. When the whole surfaces of the terraced beds are levelled, the sod is carefully laid down. This method now described is that which takes the least quantity of water; but where a larger quantity is required, or the nature of the ground demands it, as where the inclination is not very great or pronounced the mode of laying out the land on the system "en ados," or as it is known in this country "ridge and furrow," is adopted. This method is again divided into two classes—first, where the width or breadth of the ridge is the maximum, this being adopted where the land is of good quality with a permeable subsoil; and second, where the land is cold and marshy, the breadth is on the minimum scale. In the first, or broad-ridge system, the full width of the ridge

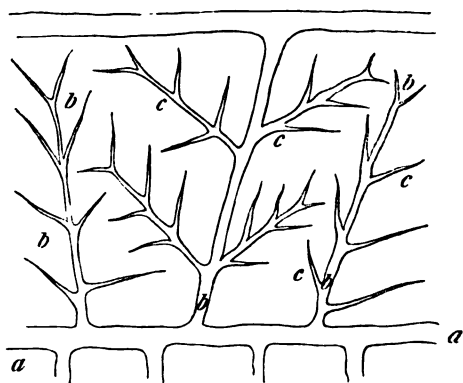


from *b* to *c* is 60 feet, each slope, as *a b* or *a c*, being thus 30 feet wide. The length of the ridge, and, consequently, of the irrigating channel *a*, which runs along the apex of the ridge, is 90 feet, where the channel *a*

enters the main channel of supply; it is $1\frac{1}{2}$ feet broad, and 5 inches deep; it tapers to a breadth of 1 foot at the extreme end of the ridge. The width of the main channel of supply at the head of the ridges is 2 feet, with a depth of 6 inches. In the second class of this system, that is, where the ridges are narrow, the full width from *b* to *c* is only 20 feet, each slope, as *a b* or *a c*, being 10 feet, the length of the ridge being 60 feet. The irrigation in these fields is not carried on during the winter when there is frost or snow upon the ground, although in mild open weather the water may be applied. Early spring is the busy season, but it is in autumn that the best effects of the irrigation are observable. Should storms arise, and thus cause a muddling of the water, it is not deemed advisable to use the water till settlement of the suspended matter has taken place. If the water is clean, it is a practice sometimes adopted to give a night watering, twice a-week, in the month of June; but in this month, and indeed in those in which the sun is very hot, no day watering is allowable. Irrigation is totally suspended, for a period varying from ten to twenty days, before the cutting of the grass is carried out. An average yield may be stated at from 3 to $3\frac{1}{2}$ tons per acre; the first cutting is taken about the middle of June. In the autumn, cattle are pastured on the "ridged"

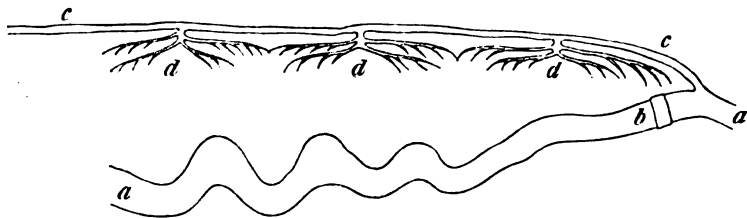
meadows, their treading action being deemed useful in keeping down the surface, which swells and becomes unequal under the influence of the water. Towards the end of autumn is the period when the irrigating channels are cleaned out, and all prepared to pass the water on to the meadows in large volume, for at this period of the year there is no fear of too much being applied; the only point to be observed is, that a uniformity of supply to all the surface is maintained, and no stagnation at any point takes place. In figs. A, B, C, and D, we give sketches illustrative of other modes of laying out irrigated meadows in Germany, of which during one's rambles one may see, here and there, examples.

Fig. A.



In fig. A, the main channel of supply is at *a a*; *b b*, *c c*, the channels of irrigation. In fig. B, *a a* the main channel of supply; sluice

Fig. B.



at *b*, leading the water to the sub-channel *c c*; *d d* the irrigating channels. In fig. C, *a a* the channel of supply; *b c d e f* the irri-

gating channels. In fig. D, *a a* the main channel; sluices, *b b*; irrigating channels, *c c*.

Fig. C.

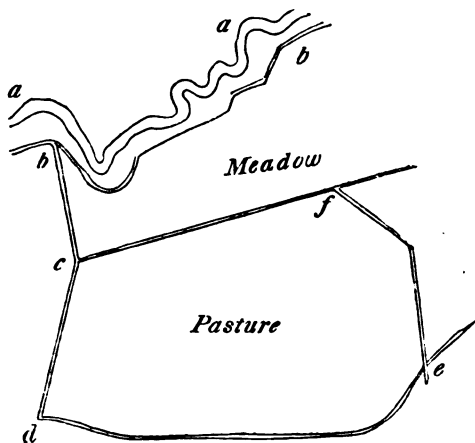
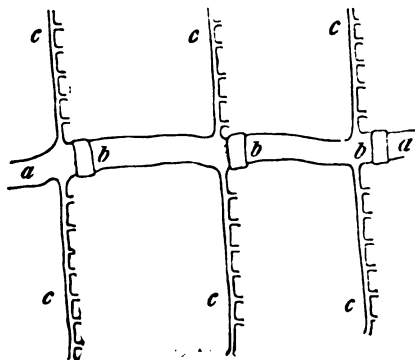


Fig. D.



FARMING AT JOHN O'GROAT'S.

THE progress which Scottish agriculture has made during the present century, is unparalleled in any other part of the United Kingdom. In spite of our ungenial climate, and frequently a forbidding soil, not only has improvement taken place in the ordinary details of farm practice, but thousands of acres have been rescued from nearly absolute sterility, and converted into fruitful fields and valuable farms. Of this, abundant evidence may be easily enough found in nearly every part of Scotland, but the most striking illustrations are to be met with in the more northern counties. We say this, because agricultural improvement in the north has been comparatively more recent than in the southern and midland districts, while the natural obstacles which it was necessary to contend against were, in most cases, considerably greater.

Long after agricultural improvement had made rapid strides in other districts, and a complete change had been effected in the character of the farming of the south of Scotland, very little had been done to ameliorate matters in Caithness, the most northern county on the mainland of Scotland, or in the still more remote islands of Orkney. Those districts were in a great measure shut out from the rest of the kingdom by their geographical position; intercourse with other places was irregular and expensive, and the people, therefore, lacked those incitements to improvement which agriculturists elsewhere possessed. This state of matters, however, no longer exists, nor has it, in fact, existed for several years; and if agricultural improvement was of slow growth at first in Caithness and Orkney, it has certainly made greater advances latterly in those districts than in any other part of the kingdom—that is, comparing what it was thirty or forty, or even twenty years ago, with what it is at the present day. In effecting this, steam has, of course, exercised a material influence, and though hitherto confined to the facilitation of communication by sea, there is every probability that, in a short time, the services of the now indispensable iron horse will be called into action in Caithness. Railways have already reached Bonar Bridge, and as people are beginning to look upon the difficulty of “crossing the Ord” as by no means that insurmountable barrier they once considered it to be, there are good grounds for believing that, in a much shorter time than many suppose, direct communication by rail between John o’Groat’s and London will be established.

The general appearance of Caithness has been described as flat, but this is scarcely correct. On the south and west it is of a mountainous character, while in the more central and eastern parts of the county the surface is undulating, occasionally rising into eminences of considerable comparative height. It is flat, no doubt, when con-

trasted with the adjoining county of Sutherland, but it is chiefly the absence of extensive plantations which serves to impart a certain degree of tameness to the landscape. This feature is more visible to one accustomed to the rich beauty which belongs to a judiciously planted district; for even wood is calculated to give a sombre aspect to a country, at least when it exists in excess, or where plantations have been made without regard to picturesque effect. As it is, we find that some attention has been paid of late years to planting in Caithness, and we consider that the trials have been sufficiently successful to induce its extension, at least when the ground has been properly prepared, and the young trees carefully attended to. Thus we find Barrock House, the seat of Sir John Sinclair, Bart., of Dunbeath, surrounded by a considerable extent of plantations, which have thriven very satisfactorily, especially since the ground was drained. Sir John extended the plantations at Barrock by transplanting trees eight or nine years old, as the first made plantations became too thick, and those transplanted trees have done remarkably well. The general arrangement and appearance of the lawns and shrubberies at Barrock is enough to make one forget he is in Caithness; and proves sufficiently, were there no other evidence, that much could be done in this way to beautify Caithness scenery.* But plantations also exist at Stirkoke, Castlehill, Forss, and other places, and we hope that this really important matter will be more attended to than it has been by Caithness proprietors. It is important, were it for no other purpose than to afford shelter; and we would merely hint, in passing, that the ground which is intended to be planted should be well drained, trenched, and enclosed, in the first place; and next, that the plantations should be made as much as possible in masses, and not in narrow belts. By planting in masses, it would be found that although the outer trees might be dwarfed by the prevailing winds, those in the body of the mass would be so much sheltered, even by the dwarfed plants, that they would grow to a greater height, so that the plantation would ultimately consist mostly of useful trees. This cannot be effected when plantations in exposed districts are confined to narrow belts or small clumps.

The soils found in Caithness vary from deep peat to light sandy

* It may be interesting to know the trees which Sir John has found most suitable. These are the sycamore, ash, Scotch elm, and purple beech. The common beech does remarkably well for hedges, but, as trees, they get bushy at the top, and do not "furnish" sufficiently. He finds the Scotch fir and larch to be useless, but spruce fir succeed, particularly the black American. The black Austrian pine also thrives well. Several evergreens succeed as ornamental shrubs, and rhododendrons never fail. We also noticed some thriving specimens of the more recently introduced coniferæ at Barrock; and Mr Hutchison gives a list of the latter which are growing at Forss, in Caithness, in the Appendix to his prize Report, which appears at page 187 of the March number for this year of the 'Transactions of the Highland and Agricultural Society.'

"links" or downs, but that which prevails in most parts of the county is a clayey loam. The principal underlying rock is the clay-slate, which in some places approaches the surface so closely as to render the available soil extremely shallow. In other places there is a considerable depth of close retentive clay, which must be drained effectually in order to enable cultivation to be carried on with any degree of success. The clay-slate has generally a very slight dip, and in many places the beds appear to be almost quite horizontal, and when the rock is close to the surface, draining becomes exceedingly difficult. In such cases it is necessary to cut a bed in the slate for the reception of the pipe or tile. A great deal of money has been expended by Caithness proprietors on drainage during the last twenty years, and there is still abundance of room for improvement in this matter.* The undulating nature of the surface affords in general plenty of fall, but some of the small streams which form the great main-drains of considerable districts, sometimes either run sluggishly, or are so serpentine in their course, as to impede instead of facilitating the discharge of flood waters. One of those serpentine streams ran through part of the Barrock estate, and flooded extensive tracts in its vicinity, rendering the land practically useless for a great part of the year. In order to prevent this, Sir John Sinclair set about straightening the course of the river and embanking it. The width of the cutting varies from eighteen feet to about forty feet. The embankment on each side of the stream is placed about 20 feet from the margin, and is from 14 to 18 feet wide at the base, 7 feet high, and tapering to about 2 feet in width at the top. A large open ditch 12 feet wide by 6 feet deep, runs along the back of the embankment, at the distance of about 8 feet from it, for the purpose of catching land water during floods, until the main river becomes sufficiently low to allow all the water to be run off. The result has been, that not only is Sir John's property improved, but an outlet has been afforded for his neighbours, who could not have drained their lands unless he had first straightened and cleared out the river's course. About 3000 acres have in this way been rendered available for useful purposes.

But we are hurrying on too rapidly, and before proceeding further we shall glance briefly at some of the earlier stages in the progress of agricultural improvement in Caithness.

Until nearly the commencement of the present century, the state of agriculture in that county was very depressed, and, as a writer in the 'New Statistical Account,' published in 1841,† justly re-

* We understand that about £70,000 have been borrowed from Government for drainage by Caithness proprietors, and their private expenditure on drainage, and other improvements connected therewith, must have been very large; but there is no data to go on which would enable us to arrive at anything like a correct estimate of the total amount which has been expended in this way during the last twenty years.

† Blackwood & Sons.

marked when giving some of the details, "its arrangements were as hostile as they possibly could be to all improvement." That such was the case will be seen by the following extract, which we take from the report of which we have just made mention :—

"Each property was divided into townlands. In every townland there were what was called 'the mains,' which consisted of a farm on which were a barn and a stackyard. The proprietor retained the mains in his own hand. The remainder of the townland was divided into what were called penny-lands, halfpenny-lands, farthing-lands, and, octos. These were measured out by shrewd countrymen, called land-riders, or more properly land-redders, for they did not ride. In accomplishing their work, they spaced six spaces as the breadth of a rig of corn-land, and 240 as the length. This they denominated a firloft sowing of oats. This, multiplied by four, the number of firlofts in a boll, gave 5760 square spaces, being precisely the number of Scotch ells in a statute Scotch acre. The land-redders knew nothing about surveying, nor had ever heard of a chain, or of an acre; yet it must be plain that, long before the memory of man, their measurement must have been founded on actual mensuration by the chain.

"The grass-land, outfield, or in-arable, was assigned in fixed proportions to these different divisions; and a certain rent, varying in different townlands, was laid on the grass-land, and a certain quantity of grain to be paid for the corn-land of these various penny, halfpenny, farthing, and octo lands. To render the state of matters still more opposed to all improvement, the custom of run-rig was common. This most barbarous custom was said to have originated in times of universal and incessant feuds, as a preservation against one neighbour's setting fire to the field of another, and to make the whole townland equally anxious to resist an enemy in case of invasion.

"These penny-lands, &c., were let to small tenants, who, besides the rent already specified, yielded an infinite variety of minute services to the landlord. The tenants of each penny-land, for instance, had to bring out their own plough, fully equipped, early in spring, and plough half an acre of oat-land in the mains; to send a man to sow the seed; to send their harrows and harrow the ground; to send two persons to carry, on the horses' backs—for there was not a cart in all the parish—the manure in straw baskets, called *caizies*, for the bear-land; to sow the seed; to harrow it with their own harrows: in summer, to mow the natural grass, to make it into hay, to carry it to the yard, to build it into stacks, to send a person to weed the corn, to cart 400 *feal* for building houses, and 300 *divots* for thatching them: in harvest, to cut down a certain quantity of corn, to carry it, and build it in the stackyard; to furnish a certain number of *winlins* to thatch the mains stacks, a certain quantity of drawn straw to thatch the mains houses, and a certain quantity of *simmins*—that is, plaited straw ropes—to bind down the thatch; to thrash a certain quantity of corn in the barn, to dry it in the kiln, to carry it to the mill, to carry the meal thence to the girdle, and to ship it on board for exportation; to carry one letter in rotation to any person in Caithness; to give a certain portion of peats, to dress a certain quantity of lint, to winter a certain number of cattle, to pay one fat lamb, two geese, hens, chickens, eggs, &c., &c. The land-redders laid off to each penny-land such a proportion of arable land as they thought would sow twelve bolls of small oats, or eight bolls of bear. Of the natural grass-land assigned to each penny-land, the tenant had exclusive possession only till the corn was off the ground, when the whole again became common till the next spring. Instead of being encouraged to take in and improve any part of the outfield-land, the tenants were expressly debarred from doing so, or, in the country phrase, corrupting their leases, and were

prohibited from cultivating any more than the portion of corn-land which had been ridden off to them.

"The state of agriculture was what might be expected from such wretched arrangements. There was not a cart in the whole country; not a potato nor a turnip, nor sown grass, was known. No rotation of cropping was observed, except that the arable land was always alternately in oats and bear, the manure being invariably put on the bear crop. Not a drain was dug, and not a fence was to be seen, except about a field or two round the proprietors' houses."

It is somewhat strange that while such a state of matters existed so late as the commencement of the present century, either from the state of Caithness agriculture or commerce, at a much more remote period the weights and measures of that county were the standards of Scotland. Thus the late Mr James T. Calder, in his 'Civil and Traditionary History of Caithness,' informs us that by a royal ordinance or act of David II. of Scotland, it was enacted "that ane common and equal weicht quilk is called the weicht of Caithness (*Pondus Cuthanie*) sall be keeped and used by all men in buying and selling within this realm of Scotland," and this early specimen of a "Weights and Measures Act" Mr Calder considers "sufficient proof that Caithness, notwithstanding its remote situation, was, at the early period in question, a place of considerable commercial importance."

Agricultural improvement in Caithness owed its origin, in the first instance, to the exertions of the late Right Hon. Sir John Sinclair, Bart. of Ulbster; the late James Traill, Esq. of Ratter, who was for many years Sheriff of the county; the late Lord Duffus, then known as Sir Benjamin Dunbar; the late William Horne, Esq. of Sconthel; and the efforts of these gentlemen have been ably followed up by other proprietors. Sir John Sinclair's earliest attempts at improvement were made, we believe, on the estate of Langwell, which he purchased in 1788 for £7000. On this estate he planted extensively, rendering it the most beautiful and romantic spot in the county; and it was on that property that he first introduced the Cheviot breed of sheep, and the Langwell flock, under the skilful management of the subsequent proprietors, the late Mr James Horne, and his nephew Mr Donald Horne, W.S., Edinburgh, ultimately became one of the most celebrated flocks in Scotland. The Langwell estate, which, as we have said, was purchased by Sir John in 1788 for £7000, was sold by him to Mr James Horne in 1813 for £42,000, and Mr Donald Horne sold it about four years ago to the Duke of Portland for £90,000. Since the purchase of Langwell, his Grace has bought other estates in the county, and is now, we believe, the largest proprietor in Caithness. Some of Sir John Sinclair's projects were rather visionary, but he was actuated by a sincere desire to benefit the country; and though some of his schemes were destined to prove abortive, there is little doubt that the present state of Caithness, which we feel

assured surpasses in many respects even his most sanguine anticipations, is traceable to the stimulus which he was the first to give. The roads in Caithness, which are now the admiration of every one who travels over them, were first commenced by Sir John Sinclair; and to him also is owing the mail-coach communication with the south, which was opened in 1818, and which has in no small degree contributed to the prosperity of the county. Of a less practical nature were his attempts to introduce merino sheep and nightingales into Caithness; but these, and perhaps some other matters, were schemes soon lost sight of in the realities of the actual good which his patriotism conferred not only on his native county, but on Scotland at large. Mr Traill, on the other hand, was a thoroughly practical man; and one great cause of his success in all his undertakings was the deep respect—we may almost say the veneration—in which he was held by everybody. “Shirra Traill” will long be remembered in Caithness; and we have no doubt that for many years to come his name will continue to be “a household word” in that county. The late Rev. Mr M'Kenzie justly says, in his statistical report of the parish of Olrick, that “Mr Traill may well be called the author of all improvements in the county, which a single view of his property in this parish, after surveying Caithness, will sufficiently testify, either as regards culture, plantations, buildings, harbours, roads, live-stock, or crops; indeed, what he has accomplished could scarcely be credited as being the work of one individual, and is, and will be a great example to Caithness proprietors in all time coming.”

But while we refer to the efforts made by these gentlemen, we must not forget to “render honour to whom honour is due;” for if Mr Traill and Mr Horne were zealous promoters of agricultural improvement in Caithness, it is well known that much of the success which attended their exertions was justly due to their able coadjutors, Mr William Darling and the late Mr James Purves, who for many years filled the responsible office of factors on the estates of Mr Horne and Mr Traill. Having enjoyed the privilege at one time of being intimately acquainted with these gentlemen, we can heartily enter into the truth of Mr Calder's remarks regarding them when he says:—

“Possessed of great intelligence, and thoroughly acquainted with the best mode of husbandry in the south, of which they are natives,* they introduced the system, as far as it was practicable, on the estates under their management, and showed in a very satisfactory manner what great improvements, superior skill, combined with a judicious outlay of capital, could effect in a soil not naturally rich, and in a changeable climate like that of Caithness. In the agricultural annals of the county their names will have a permanent place.”

* Mr Purves died after Mr Calder wrote the above.

Sir George Dunbar, Bart., the late Captain Henderson of Stemster, as well as his son, Mr Alexander Henderson, the present proprietor, Sir John Sinclair, Bart. of Dunbeath, Mr Hugh Davidson, Mr Adam of Lynegar, Mr James Henderson, Mr Smith of Olrick, Mr Sinclair of Forss, and others, have also been most earnest, as well as successful, in their exertions for the improvement of Caithness farming ; but we shall have occasion to refer in a more particular manner to details in the course of our remarks.

It is not too much to say that the first decided start which the reclamation of waste land received in Caithness arose from fish-offal and marl. The former has been obtainable in considerable abundance at Wick and other fishing stations on the east coast of Caithness ; and the value of this article as manure is shown in a report supplied to the Highland Society by the late Mr John Leith, relative to the cultivation of waste lands near Wick. Mr Leith's report is given in the eighth volume of the Society's 'Transactions ;' and we may remark, that notwithstanding the immense extent of waste land which has been reclaimed in Caithness, Mr Leith's report is the only one, so far as we know, which has been sent in to the Highland Society. We are informed by that report that in the year 1824 Mr Leith took from Lord Duffus a tract of waste land near Wick, consisting of 156 imperial acres, on an improving lease for thirty-one years, at the yearly rent of L.31, 6s. The land consisted chiefly of a strong clay soil, with a portion of bog or moss, and, previous to being reclaimed, "its only produce was heath, and a coarse kind of grass, called bur-grass." Mr Leith commenced operations in the autumn of 1824, and in 1828 the whole farm was in cultivation. With reference to the use of fish-offal, Mr Leith states that

"The only manure which was applied to the lands in raising a first and second crop of oats, was a compost of moss and clay, mixed with herring guts, which, from being situated near the fishing stations of Wick and Pulteneytown, were easily obtained. The compost has uniformly been prepared and applied in the following manner :—The herring guts were carted away from the curing stations each day during the fishing season, which generally commences about the 20th of July and ends about the 10th of September, and laid down at the most suitable places upon the lands. They were immediately mixed with clay or moss in the proportion of from eight to ten cartloads of clay or moss to each cartload of guts. In this state the compost remained till about the middle of December, when it was trenched up ; and in about fourteen days thereafter the operation of spreading the compost commenced upon the new land which had been ploughed up the preceding autumn. In the application of the compost particular attention was paid that the part which was prepared with clay was applied to the mossy ground, and that the part which was prepared with the moss was applied to the clayey ground. It was always found to be most advantageous to apply this compost early in the season, as, when delayed till late in spring, and when a tract of dry weather follows, the bad effect produced is very obvious. From fifty to sixty cartloads of compost per acre were generally applied for the first crop of oats, and a fourth less for the second ; in the third year no compost or other manure was given to the land."

With respect to the result of his improvements, Mr Leith stated

that they had been "attended with complete success, and a large tract of land, which four years ago presented the appearance of nothing but stunted heath and coarse grass, is now changed to corn-land and green fields, bearing crops hardly equalled by any in the country." The subsequent introduction, first of bone manure, and then of other artificials, has been of immense advantage, enabling those who were situated far from localities where fish-offal could be procured to reclaim and fertilise their waste lands equally well with those who had access to the refuse of the immense herring fishery which has been carried on for many years on the coast of Caithness. Fish-offal, however, is still in demand wherever it can be got.

Marl, the other article to which we have ascribed an exciting influence with respect to the improvement of waste lands, exists in great abundance, and of very superior quality, in Caithness. It is found chiefly in the beds of the different lochs, of which there are a considerable number in the county, and when required was raised by dredging. A large deposit exists on the estate of Mr Sinclair of Forss, whose father drained the loch, and thus rendered it easy to get at the marl, which is rich in carbonate of lime. The only analysis of Caithness marls which has been made is, we think, one by the late Professor Johnston, and the specimen, in a dry state, contained nearly 85 per cent of carbonate of lime.

But the abundant supply of marl in Caithness led to its abuse, and the result is that it is now comparatively little used, being apparently considered, in fact, a dangerous article to meddle with. When it was first applied as a manure, the effects produced by it were so striking that people somewhat naturally imagined, considering that they had no agricultural chemists in those days to guide them, that it was impossible to have too much of a good thing. Heavy crops of oats followed its application, even on poor land; and when merely spread over the surface, it had the effect of extirpating the stunted heather and coarse grasses, while the place formerly occupied by these useless plants was taken up with white clover and other plants of a more valuable nature. Everything combined, therefore, to lead to the extensive use of marl; and we have reason to believe that the quantity applied per acre was at one time nearly four times as much as it should have been. Then ten or twelve crops of oats were grown in succession, for people seemed to imagine they had got hold of a substance which possessed an illimitable power of producing corn; and, as will be readily imagined, the inevitable consequence of such treatment followed, for the crops ultimately dwindled away, until at last the soil refused to produce oats. When this took place, there were some who proceeded to render matters worse by applying a fresh quantity of marl, under the impression that by so doing fertility would be restored to the land, so that they might go on growing abundant crops of oats,

year after year, as they had previously done. It required only a short time, however, to convince them that a grievous mistake had been committed; the oats brairded, indeed, but soon withered away; the soil got loose and puffy under the foot; and though tolerable crops of turnips, bear, and grass were produced on the land, its oat-producing powers were evidently at an end. As most persons are usually unwilling to blame themselves when any untoward result occurs in their course of procedure, the fault was laid on the supposed intrinsically bad qualities of the marl, and not on the excessive application of it in the first instance, nor yet the exhausting system of cropping which had followed its use as a manure. Hence a prejudice has arisen against it, on the same principle that "a burnt child dreads the fire." But as a fire is a very useful thing, provided one does not poke their fingers into it while warming themselves, so marl is also valuable when used with judgment. People at the present day point to certain farms or fields in the county which have been "ruined by marl," as they call it, but it was by marl applied in excessive quantities, and followed, in many early cases at least, by an exhausting system of cropping. It is requisite that lime shall be present in soils, for most plants cannot be grown in perfection without it, and some refuse altogether to grow when it is absent, so that it must be artificially employed when it is wanting, as in the case of the clay and peaty soils of Caithness. Lime must be brought from the Frith of Forth or Sunderland, as limestone is comparatively rare in Caithness, so that it is a pity its own deposits of rich shell marl should be overlooked, or that any prejudice should exist against its use; for the fact is, it depends upon people themselves whether it prove beneficial or injurious. But in this it does not differ from lime, which has been productive of precisely similar results when misused in other districts.

It is extremely difficult to restore fertility to land which has been over-marled. We have known fields in that state to lie many years out in grass, and yet, when broken up, the injurious effects of the superabundant supply of marl, which at one time had been laid on the land, were just as apparent as ever. Deep trench-ploughing is the principal remedy; and to effect this, the Tweeddale subsoil trench-plough, which breaks the under stratum, and partially intermixes it with the upper soil, is the best implement that can be used. But, unfortunately, it is usually the case that there is not enough of soil to operate upon where marl has produced injurious effects from having been applied in too large quantities, at least in Caithness, where the underlying rock frequently approaches quite near the surface, and lies horizontal to it. In such cases, perhaps the best thing to do would be to change the rotation to some extent; that is, as oats will not grow on over-marled land, let that crop be omitted altogether, and the field, when broken out of lea, put at once under

turnips. Tares also will grow on such land, and the crop when sown early in successive breaks could be consumed on the ground by sheep, as we find done on many strong soils in England. This would not only help to enrich the land, but the treading of the sheep would also be advantageous to it, while the crop would afford additional food for sheep, which is always a matter of great importance to the Caithness farmer. In offering this suggestion, we wish it to be understood that we are judging from analogy, and not from actual experiment; but the matter is certainly worth a trial. We repeat, however, that the rich stores of shell-marl which exist in Caithness should not be neglected in the reclamation of waste land, or the improvement of that which has been for some time in cultivation, but that the marl should be applied with judgment, so that its abuse in former times may act rather as a guide than as a hindrance. On different parts of the coast of Caithness, there are large quantities of shell-sand, which has also been used in the reclamation of land, and which, of course, owes its fertilising influence to the lime contained in it.

It is difficult to state exactly what extent of land has been reclaimed in Caithness even during the last twenty years, but that a large increase has been made to the area under cultivation there is not a doubt. Not only have extensive tracts which were formerly of little value been brought under the plough, but odd patches included within the bounds of old cultivated farms have been also reclaimed, so that in many places the entire appearance of the country is quite changed. This is more visible, perhaps, to any one who knew the county some years ago, and who has been absent from it for a considerable time, than to those who have been residing constantly in it, and to whom the altered aspect which many places now present have been familiarised by constantly seeing what was going on. As affording some criterion by which we may judge of the progress made, it may be stated that the valuation made at Whitsunday 1863 was £16,788, 18s. above that made in 1857. The annual valuations, which are prepared for the purpose of regulating public assessments, have been conducted for several years by Mr James M'Kay, Thurso, with perfect satisfaction to everybody, for it appears that the correctness of his valuations has never been called in question.

A striking, as well as a recent example of reclamation of waste land and general estate improvement, is to be found on the property of Sir Robert G. Gordon Sinclair, Bart., particularly in that part of his property which lies in the west side of the county, between the river of Forss and Reay. There was a good deal of land on that estate which had been for a long time in cultivation, particularly about the "mains" farms, but until recently a large proportion of it was a sheep-walk, the vegetation which covered the surface being chiefly short heather and bent. The improvement of the estate was commenced about five years ago, and since that time

upwards of 1000 acres have been reclaimed, the land being thoroughly drained wherever such was necessary, watercourses cut and straightened, roads and fences made, and farm-buildings repaired or newly erected. The large farm of Upper Downreay, of which Mr Brown is the tenant, may be considered altogether a new farm, and on this a capital steading has been built, with sufficient cottage accommodation of the best kind for the farm-servants, and an excellent dwelling-house, in the construction of which the orthodox front of five windows and a door has been departed from, the house being what we are accustomed to consider more of the English style in its general appearance and arrangement. Another excellent farm-house of a similar superior description has been built on the farm of Lower Downreay, former occupants having been lodged in an old castle which stood close by the sea. The farm and other cottages on the estate are substantial, and of different sizes, some containing two apartments, others three, and in some cases four apartments, to suit different families. Suitable accommodation has also been provided in the case of other farms on the property, the possession of a flag quarry affording great facilities for flooring, roofing, and other purposes, in the erection of farm-buildings and other improvements. In working this quarry, the best description of marketable flags which are raised are prepared for export, so that it is only the second-rate kind which are used in building, fencing, &c.; but the sale of the marketable flags helps to lessen the general outlay.

The reclamation of the land after draining consists in ploughing the heathy surface, and it is allowed to lie in this state for some time, in order that the sod may rot before it is again ploughed previous to oats being sown. Artificial manure, such as Peruvian or phospho-guano, is applied as a top-dressing to the crop, and a second crop of oats is sometimes taken, as this tends to rot the tough furrow still more completely. A crop of turnips, grown with artificial manure, follows; and it may be stated, as a proof of what can be done even with such an apparently forbidding subject as the land is in its natural state, that last year (1863) Mr Brown grew a crop of Aberdeen yellow turnips on his farm at Upper Downreay, on land where grouse had been shot three years previously, and with that crop he won a cup which was competed for by farmers in all parts of the county. A crop of oats follows the turnips, and grass seeds being sown with this crop, the land is then left in pasture for two years. Mr Miller, the tenant of Lower Downreay, has tried rape as the first crop in newly reclaimed land with satisfactory results, as the rape was eaten off by sheep, in consequence of which the decomposition of the tough surface was considerably hastened, owing to the treading of the sheep, while the land itself was enriched by their droppings. The rape must be sown not later than the 1st of July; and, judging from our experience of rape as an ameliorating crop under similar circumstances elsewhere, we are of opinion that

it might be more extensively grown in Caithness in the course of reclaiming waste land. Mr Miller's farm consists of 600 acres, managed on the five years' rotation, and throughout it is a well-cultivated and highly improved place. Other farms on the estate have also been much changed of late years; and while what may be regarded as entirely new farms have been laid out and are now in the course of improvement, several of the old tenants, whose holdings range from 10 to 30 acres, still remain in possession of their places, in order to give them a chance of bettering their condition. They are certainly improving their farms, and although they have not leases at present, yet these will be afterwards given to all who evince a desire to go on in a right way. Mr Tait, the factor on the estate, by whom the improvements have been designed and carried out, and upon whose business talents they reflect great credit, is of opinion that small farms should be encouraged to a certain extent, as these afford the means of keeping up that supply of farm servants and labourers without which it is impossible to get on where a regular system of husbandry is followed.

In this view he is supported by the opinion of a Caithness gentleman of great experience in the management of landed property, being both a proprietor and a rent-paying tenant; and as the question of large *versus* small farms is to some extent a "vexed question," at least in certain parts of the kingdom, we shall quote the opinions to which we allude, as they are certainly entitled to every respect. This gentleman holds that an intermixture of large and small farms is the most desirable state of matters, and that he knows no county in Scotland in a happier position than Caithness in this respect, where there are tenants paying from £1 a-year of rent, up to those who pay £1000, and generally so intermingled that the different classes assist and benefit each other. The large farmer buys the cattle, often the young calves, of the cottar, and keeps them until they are ready for exportation, besides affording a large amount of employment to all who are willing to work of both sexes, and of almost all ages. In many respects, no doubt, the small farmer works his land at a disadvantage, but he makes up for this by economy in other respects. He and his family can exist in bad times without wages, or with a small outlay, and when matters improve they have often something over for deposit in bank. As a rule, the smaller class of tenants—that is, those who farm from 20 to 70 acres of arable land—will pay as much rent per acre as the large farmer, while they very frequently do more in the way of improvement in proportion to their extent of holding, without aid from their landlord. A proprietor can improve his estate more economically through the medium of the smaller class of tenants, but he may not do it so quickly as with a tenantry holding larger farms. On the latter there is generally a considerable outlay under a new lease for houses, fences, roads, and drainage, upon much of

which, of course, the tenant pays interest; but still the money must be found. Many small farmers do everything for themselves, although, in general, proprietors assist them to some extent. But a cottar class could not exist in the comfort they do in Caithness, and improve waste land in the manner they do, if they were not willing to work, and if they had not a constant demand for their labour, whenever they have the time to spare from the cultivation of their lots. This demand for labour exists to a remarkable extent in Caithness; for while the labourers by profession do the steady work, there is ample employment for all others at quarries, roads, farm improvements, &c., when they can turn their attention to such matters; and as wages run from 12s. to 14s. per week, these, with cheap living and lodging, leave an ample margin. Those who have horses, too, need not keep them a day idle, as there is always plenty of carting work to do, which is well paid for.

Other proprietors and tenants in Caithness have also brought in a great deal of waste land; and, indeed, there has been some land reclaimed which might as well have been left in its natural state—we mean land where the soil is too shallow to allow of its ever becoming of much value for the production of crops. We observed in several places that land had been considerably improved for sheep pasture, simply by means of surface-draining and enclosing, without any attempts at tillage being made; and that is evidently the best use to which land, not suitable for cultivation under a regular rotation, could be turned.

The most prevalent course of cropping in Caithness is the five-shift—viz., 1st, oats; 2d, turnips; 3d, oats or bear, and sometimes barley; 4th and 5th, grass. Sometimes the pasture is allowed to remain a third year without being broken up, but this is not general, as the value of pasture is much less the third year than it is either in the first or second, unless it gets some help in the shape of top-dressing of some sort or other. For instance, we saw considerable improvement made in the grass of the third year by means of an application of seaweed. It appears to us, however, that pasture of a more permanent nature might be secured, when such is considered desirable—first, by sowing a mixture of grasses calculated to produce permanent pasture, and next, by means of occasional top-dressings with composts.* Sir John Sinclair has had some of his fields at Barrock in grass for twenty years, and he has improved the pasture very much by applying a compost of lime and earth as a top-dressing. Lime is essential to the growth of white clover, &c., and for this reason must be artificially applied where it does not exist naturally in the soil. Now, even on farms in Caithness where you will be told that permanent pasture does not succeed, there will be found corners and odd patches thickly planted with white clover

* See 'Journal of Agriculture,' October 1863, page 101.

and other grasses of a permanent description, quite enough to make one wish there was more of it, especially when such is contrasted with the thin sole of the second or third year's grass. Of course, when a farm is cultivated strictly under a rotation, permanent pasture does not form any part of the system of management, but there are cases when an old grass field or two will often be found very serviceable, especially when the pasture afforded by such is of a valuable description. There is one thing which certainly ought to be taken into consideration with regard to the present appearance of those pastures in Caithness which form part of a rotation—namely, that for some years past the weather has been so unfavourable that a great deal of the grass seed, clovers, &c., perished in the soil, and for this reason the pastures which we see this year are not so good as they would otherwise have been.

In some cases the four-shift rotation is followed, but this can only be done where there is an ample supply of manure at command. The proportional average of the crops in Caithness in 1857, as given in Mr Hall Maxwell's valuable returns, was as follows :—

Wheat,661
Barley,587
Oats,	38.467
Bear,	4.409
Vetches, &c.,687
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Total percentage of white crops,	44.811
Beans and pease,033
Turnips,	15.315
Potatoes,	2.729
Mangold,	.	.	.	.	.	.005
Carrots, cabbage, &c.,	.	.	.	.	.	.040
Summer fallow,	.	.	.	.	.	.195
<hr/>						
Total percentage of green crops and fallow,	.	.	.	.	.	18.317
Grass and hay under rotation,	.	.	.	.	.	36.872

We believe that the cultivation of potatoes has fallen off since 1857, there being a corresponding increase in the breadth of turnips grown.

The variety of oats chiefly grown in Caithness is the Sandy, which gives more straw than the Early Angus, an important consideration where oat-straw is so valuable for fodder; it is also an equally early variety, and the grain is about equal in weight. Early Angus is grown on the richer soils, after turnips. Potato-oats and also the Hopetoun variety are occasionally grown, but they are not general favourites. The Berlie oat is also grown to a small extent; but an experienced agriculturist informs us that he has found it is liable to deteriorate rapidly. The Canadian oat has been introduced from Aberdeenshire, but Caithness experience of it, so far, has not been favourable, although it weighs well to the bushel elsewhere. The old black Murkle oat, which was common at one time in Caithness,

and may be said to have belonged to that county, is now believed to be extinct.

Caithness farmers are generally advocates for thick sowing, as thin sowing tends to make the crop late, which is just the very thing they have to guard against. The usual quantity of oats sown is from five bushels to six bushels per acre, never less than the former, and sometimes more than the latter, according to the condition of the land. Broadcast sowing is generally preferred, the drill machine not being liked for this purpose. All this, we doubt not, would horrify Alderman Mechi, but Caithness-men have a climate to contend against of which he knows nothing in Essex, although he wishes apparently to lay down Tiptree Hall rules for the guidance of agriculturists under every condition of soil and climate.

In the breeding and management of live stock a great improvement has taken place in Caithness, as well as in the cultivation of the land. Shorthorn bulls were first introduced into the county by the late Mr Horne of Scouthel, about 1820, and those bulls were used in crossing West Highland cows, and the common breed of cattle which then prevailed in Caithness, and which was an inferior, flat-ribbed, plain-skinned description of stock. The crosses produced in this manner fattened more rapidly than the original breed to which the dams belonged, and their value became established in a few years in consequence of the high prices they realised when sent to London, and other markets in the south. This had the effect of drawing attention to the improvement of cattle by the use of shorthorn bulls; and the practice has now become not only universal, except in the more hilly parts of the county, but is also pursued in the only manner which can secure success, namely, by the use of the best description of bulls. Thus, for instance, Sir John Sinclair has been using Malachite (18,313) for the last three years, for the purpose of crossing Galloway cows, or cows which are first and second crosses from the pure Galloway cattle. Sir George Dunbar, Mr Henderson of Stemster, Mr Swanson of Gerston, Mr Adam of Lynegar, and other gentlemen, have also highly-bred bulls; but the simple fact that such an animal as Malachite is employed for this purpose, is very sufficient to show the care bestowed on the breeding of cattle in Caithness.

The result is that a high value is set upon Caithness crosses by feeders and butchers. As far back as 1838, Mr Horne got £40 each in Smithfield for a lot of twenty four-year-old cattle—a price which was considered very remarkable at that time. For several years the cross-bred cattle were retained in the county until they were two or two and a half years old, but they are now chiefly sold when yearlings, and the best lots are all cleared out of the county by the beginning of July. At that time they are fourteen or fifteen months old, and their value ranges from £10 to £15 a-head, and as much as £18 each has been got for them when kept over until

October ; that is, when they were eighteen or twenty months old.

There appears, indeed, as if there is some inherent property in the soil of Caithness which is favourable to the production of large-sized stock. The old breed of Caithness cattle was distinguished for this when the cattle became aged, being of slower growth than the improved animals of the present day ; and the latter retain the same character, but it is much sooner developed in their case, from their disposition to arrive earlier at maturity, in consequence of their connection with shorthorn blood. It would be interesting to know whether this tendency to produce large-framed animals arises from an abundant supply of phosphates existing in the prevailing soils of Caithness, or from some other cause. It is an established fact that the bony structure of animals cannot be produced unless there is a sufficient quantity of bone-earth—phosphate of lime—supplied in their food ; and as the food comes from the soil, that supply of bone-earth must primarily exist in the soil. We have known a case where pastures, which have been for more than forty years grazing-ground for young cattle, have latterly ceased to produce any improvement in the cattle with respect to the growth of the animals, the obvious cause being the exhaustion of the phosphates owing to the many successive generations of young beasts which had been reared on the land carrying off the phosphates in their bones, &c., so that ultimately it became quite evident that young cattle put on the pastures for the summer were not much larger at November than they were in May. If therefore Caithness soils have a tendency to encourage the growth of young stock, may we not be quite right in supposing that there exists in those soils a large supply of phosphatic material, seeing that the want of it in other cases has produced just the opposite effect ?

It has been observed by Caithness breeders, that while the first cross from the Highland or Galloway shows generally much neatness with nice quality, the cattle do not attain the size of the second cross ; but after that, if further crossing is persisted in, there is a loss of constitution, which renders it necessary to go back as much as possible to the original stock. This quite corroborates what was stated in our article on "The Crossing of Stock," which appeared at page 63 of the current volume of this Journal. Those who pay attention to the progress of their cattle, give the calves 1 lb. to 2 lb. of cake and bruised oats daily, along with turnips and straw, during winter and spring, commencing with a smaller allowance of cake after the calves have been weaned ; and the general features of the system pursued in Caithness by the best breeders, with reference to the breeding and rearing of cattle, may be briefly summed up as follows. Assuming that the breed is all right, it is so arranged that the calves are dropped, if possible, not later than the middle of March, and each calf has 8 quarts daily of

warm milk, divided into three meals, direct from the cow. Some allow the cows to suckle their calves. The calves are kept on warm milk for about fifteen weeks, but when they are three weeks old they get a little oilcake, made into a jelly with hot water, at any or all of the meals. The quantity of cake given is gradually increased, until it reaches first half a pound, and then a pound per day. At the end of fifteen weeks, skim-milk is substituted for the warm milk; and this, along with the cake, is continued for a month longer. The calves are then well grazed, and generally sheltered at night. Not later than the first of November, and even sooner, the daily ration of 1 lb. of cake is resumed, which is continued until the stirk goes to grass next season, and for a fortnight longer if the beast will eat it. When the calves are put on turnips, the daily allowance is about 40 lb. per head, and this is gradually increased to 60 lb., divided into three meals, with oat-straw *ad libitum*. When the stirks are put to grass, they are not left out more than an hour or two daily if the weather is cold, and it is necessary to shelter them at night for some time under any circumstances. When the sown grass is ready to cut, the stirks get a little of this at night. Some give larger quantities of cake than that which we have stated, with an equal quantity of bruised grain; but by the foregoing system, young beasts, if well bred, and properly attended to in other respects, will be sure to realise high prices in the June markets.

It must not be supposed, however, that Caithness crosses are all alike well bred and well kept. The use of inferior bulls results in a very middling description of stock, and we saw some exceedingly poor specimens, which certainly did not promise to prove thrifty beasts. When second-rate female crosses are used as breeding stock, and the female produce of such again crossed, and the like repeated perhaps for some generations, the loss of constitution which follows frequent crossing tells more in a case of this kind than it would have done where the original stock was of a superior nature. Hence the second-rate and inferior kinds of Caithness crosses are not quite so good now as they once were. But the remedy is plain. Good Highland or polled stock, with *pure-bred* shorthorn bulls to begin with, is the only cure,—accompanying this, as a matter of course, with fair supplies of nourishing food, so as to keep the young cattle as much as possible in a constant state of improvement. There are some good Highland cattle on farms in the western part of the county, where the nature of the pasture suits that hardy breed much better than it would do crosses; and in some places, especially among small tenants, we occasionally find a trace of the old Caithness breed.

The first attempt to improve the breed of sheep in Caithness, of which we have any record, was the introduction, as we have already noticed, of Merinos by the late Right Hon. Sir John Sinclair, Bart. of Ulbster. At that time Merinos were fashionable, being patro-

nised by George III., and every means were taken to distribute them through the kingdom. The attempt to introduce them into Caithness was a failure, notwithstanding that Sir John, in order to protect them from rot, as Calder informs us in his history of the county, "ordered a sufficient quantity of leather, and had them all equipped in boots!" His introduction of the Cheviot breed on his mountain estates was a better speculation, and it, in fact, laid the foundation of that system of sheep-farming which has rendered the northern counties of Scotland so famous. Leicesters were first introduced into Caithness by the late Mr Horne, upwards of forty years ago, but for a considerable time the spread of that breed, as well as the practice of crossing Cheviot ewes with Leicester rams, was prevented chiefly from the want of draining, and partly from insufficient enclosures. These causes having now been in a great measure removed, we find in Caithness not only a superior description of cross-bred sheep, but, as in Sir George Dunbar's possession, some capital pure Leicesters—all, however of the Border type, which is more esteemed than the modern English Leicester, as possessing greater hardiness, and producing better crosses with the Cheviot, with respect to the form of the carcass, the aptitude for fattening, and the quality of the wool. The wool of Caithness crosses is superior to anything of the kind shown at the Edinburgh sales; although the fleeces are not so heavy as those of some other breeds, but the extra quality more than makes up the difference. The sheep themselves are lengthy, large-framed animals, which fatten readily, and yield flesh of good quality.

The same loss of constitution which takes place in cattle when repeatedly crossed with the shorthorn, occurs in cross-bred sheep when the Leicester ram is used along with cross ewes for a few generations; and to guard against this, it is found necessary to go back occasionally to the pure Cheviot, by which means a restoration of hardiness is effected. Some breeders sell their lambs, while others carry them on until they are shearlings, when they are disposed of at the Georgemas market, held early in July, in a central part of the county, the buyers being from Morayshire, the south of Scotland, and also from England. At the last market, the average price of Caithness clipped hoggs, or shearlings, was 34s., and prices ranged up to 42s.; the value of the fleece produced by these sheep amounting at least to 14s. or 15s. each. The hoggs are well fed on turnips during winter, being either folded on the crop, or having the turnips given to them on a grass field, and those which are in forward condition are frequently sent off to the fat market even before they are a year old. Notwithstanding previous sales, there were between 7000 and 8000 cross hoggs on the Georgemas Hill at the last July market, upwards of 6000 of which were sold. Caithness cross-bred sheep are much liked, and we quote the following opinion of their value from a paper read by Mr Geddes, Orblis-

ton, at the November meeting last year of the Morayshire Farmers' Club :—

"I have tried the pure Leicester, the pure Cheviot, and pure Southdown, a cross between the Leicester and Southdown, likewise a Cotswold cross ; but I have ever found that, for all practical purposes, the half-bred ewes and the pure Leicester tup paid the most money—producing more weight of mutton and wool as they do, and at the same time a comparatively hardy and docile animal. In keeping up the stock of half-bred ewes, I have been in the habit of buying either half-bred gimmers or lambs from breeders in the county, who bred from the Cheviot ewe and Leicester tup, or have got first-class half-bred gimmers from the county of Caithness, where, I think, they will be found to be better adapted for this county than those bred here. The Caithness sheep are lengthier and stronger, and altogether serve to counteract that tendency to diminish the length of body, size of animal, and closeness of wool which the light land of this county produces after a few years. The Caithness breeders, from their proximity to the best stocks of Cheviot ewes, and from the stronger nature of their soil, and larger farms, have it more in their power to produce a bigger half-bred sheep than we have."

We believe that a new feature has been introduced by Mr Smith, of Olrick, in Caithness sheep-breeding—namely, by the importation of a flock of Shropshires ; and from the hardiness of that breed, as well as their size, early maturity, prolificness, and good wool, we expect they will prove as successful at John o'Groat's as they have been elsewhere. It must be understood by those who are strangers to this valuable description of sheep, that it is descended from a fine-woolled moorland race, and that its present improved state is chiefly owing to careful selection, good feeding, and judicious management. We may also state that the cross produced between Shropshire rams and Scotch blackfaced or Cheviot ewes, is productive of a description of sheep held in much estimation by feeders and butchers, and not less so by consumers, as the quality and flavour of the flesh is first-rate, particularly in the case of the Shropshire ram with the blackfaced ewe. The lambs of this cross are remarkably good for the butcher. We daresay those accustomed to the clean bright faces of the Border Leicester and the cross of that breed with the Cheviot, will not at first like the black and mottled faces of the Shropshire and Shropshire crosses ; but if the experiment proves successful, as we expect it will do in Mr Smith's hands, people will soon come to know the value of the Shropshire, and forget the colour of its face.

It has been remarked that the want of proper enclosures told very much against the Leicesters on their first introduction into Caithness, and, in fact, against sheep-farming generally on arable lands. Cattle were herded, and here and there "a bit laddie" or "lassie" may still be seen engaged in that primitive and most monotonous employment. But that is chiefly in the case of small farms, for the large farms are, for the most part, now well fenced. On each side of the road from Wick to Thurso the thorn and beech hedges are

well grown, while those on Sir John Sinclair's farm at Barrock are really splendid. We also saw capital hedges at other places. Dry-stone walls $4\frac{1}{2}$ feet in height, besides a cope which is set in mortar, form a common description of fence; and another cheap mode of enclosing is afforded by the refuse flags of the pavement quarries, which are set on edge usually on the top of the bank of earth which is thrown out in constructing a ditch; and these flag fences, if properly looked after, will last in tolerably good condition during the currency of a lease. The cost of such fences is about 3d. per running yard—that is, the stone costs 1d., the carting costs as much more, and the third penny is laid out in setting up and fixing the flags.

The farms are of various sizes, ranging from 10 or 20 acres up to 1000 acres of arable land, but small farms are not so prevalent as they once were. The middle-sized and largest class of farms are usually let for nineteen or twenty-one years, while small farms are now generally let on lease for fourteen years. Some years ago the majority of the small farms were held at will, which was justly complained of by the different reporters in 'The Statistical Account' as being injurious to the land and to the tenant, and preventive of improvement in the condition of either. The rent of ordinary farms varies from 15s. to 30s. per statute acre, but in the case of large farms where there are considerable tracts of waste land to be reclaimed, the gross rent may not be more than 7s. or 8s. per acre. Land in the immediate vicinity of Wick and Thurso, let in small portions for the accommodation of the townspeople, of course brings higher rents, and we saw some land of this kind for which £3 an acre is paid.

A few years ago there was great competition for large farms, and the rents of such consequently rose considerably. For instance, we heard of one farm which was let under the last lease at £600 a-year. It is now let at £800, and taking the different percentages into account, which have to be paid for draining, fencing, and buildings, the annual charge to the tenant is not much under £1200. But the advanced rents were in many cases found to be too high, and the result is that it has been necessary to relet some farms at reduced rents.

The fact is, for some years past Caithness farmers have had great difficulties to contend with, and it was the high prices they have got for their stock which has enabled them to pull through. The crop of 1856 may be said to have been the last good crop grown in the county until that of this year, which promises remarkably well, except in the case of the hay, which has been lighter than usual. First of all, "the grub"—the "daddy-longlegs"—committed fearful ravages on their crops, and then came a succession of cold wet summers, those of the three last years being particularly so. Even last year, when there was a heavy crop nearly all over the kingdom, Caith-

ness was, as it were, shut out from the benefit, for the favourable weather seemed to stop short at the Ord, leaving Caithness in just as bad a state as it had been in previous years. Until lately, there used to be a large export of grain from the county; but the crops for some years past have been so deficient, that the export trade has been much restricted, and it has been necessary to import grain and meal, and even farmers have been good customers to the meal-dealers, in order to procure the food required by their servants. As affording an evidence of the cold wet nature of late years, we were informed by good authority that even the wild plants did not perfect their flowers, so that the different stocks of bees, of which there used to be large numbers kept in Caithness, have almost died out, and hives have therefore become extremely rare. The turnip crops were equally a failure with the corn crops; and this was severely felt, owing to the importance of the turnip crop to the Caithness farmer for wintering his live stock, upon which so much depended. It is to be hoped, however, that matters are now improving, and that the patience and perseverance of the farmers of Caithness, under the pressure of great and unavoidable difficulties, will be rewarded by a succession of prosperous seasons which will more than repair the losses sustained in those which are past and gone.

The rent of a farm is but one part of a tenant's outlay, and another very important source of expense is found in the necessary item of servants' wages. These have also advanced considerably compared with what they were, say, twenty years ago, and they must be paid whether the land produces anything or not. The farm-servants are engaged by the year, and sometimes half-yearly. Married men get from £9 to £10 a-year in cash, with 2 quarts of skim-milk daily, 8 bolls or 80 stones of oatmeal during the course of their year's service, and they have ground to plant 60 chains—that is, 1320 yards—of potatoes. They have also a house and firing free. Young men get £11 to £14 a-year in cash, 7 bolls or 70 stones of meal, milk as above, but no potatoes, and are generally lodged in a bothy on the farm. Married men appreciate their situations, and generally try to keep them, but unmarried men are sometimes rather restless, and less to be depended on. A great deal of obloquy has been heaped on what is termed "the bothy system," and some Caithness bothies have been held up as particularly deserving of censure from their unfitness for human dwellings, and the careless manner in which they have been regulated. The bothy is simply a concomitant of farming on a large scale, for it is impossible to have married men in all cases, and young men must be lodged,—exactly as in the case of large mercantile establishments in some cities, and the eating and sleeping apartments of those establishments are just as much bothies as the accommodation provided for unmarried men on arable farms. We have not the slightest doubt that there are bothies in Caithness much in want of improvement, just as there

are farmhouses and farm-offices in the county which require to be remodelled ; but we certainly saw some bothies where even the most fastidious could scarcely find room for blame.*

We have now brought our remarks on Caithness farming to a close, and we are aware that we have omitted much information which would have been both interesting and useful. Our limits, however, compel us unwillingly to avoid making special mention of many cases illustrative of the energy and steady perseverance which have been displayed by several individuals in that county—landlords as well as tenants—in overcoming the difficulties of their position, and in removing those obstacles which beset them in carrying out their improvements. Their perseverance, however, is becoming rewarded. From being one of the most backward of the Scotch counties in point of its agricultural standing, Caithness now occupies a high position in many respects ; and we feel convinced that its position would have been even much higher than it is, were it not for the severe check it has received from the unfavourable results of the last six or seven years. The progress which Caithness farming has made has been productive of good elsewhere, and the example afforded by it has stimulated others. This is evident from the wonderful improvement which has taken place of late years in the agricultural condition of the neighbouring county, the Orkney Islands, of which we hope at a future time to be able to lay full particulars before the readers of this Journal.

* Mr Robb's interesting little work, 'The Cottage, the Bothy, and the Kitchen,' will repay perusal by all who are desirous of obtaining a faithful account, from actual observation, of the condition of agricultural labourers in Scotland.

THE DETERIORATION OF THE TURNIP PLANT, AND THE LATE
PROSECUTIONS IN IRELAND ON THAT ACCOUNT.

By AN OLD NORFOLK FARMER.

THE actions-at-law that have been tried in Ireland for the recovery of damages sustained by the loss—total or partial—of the turnip crop, in consequence, as is alleged, of being supplied with bad seed, has been the occasion of a good deal of discussion as to the real cause of this failure; and if we can depend (as I believe we may) on the facts and evidence adduced by competent and trustworthy men well acquainted with the subject, there is no reason to suppose that the fault lies in the badness of the seed, but in other circumstances attending the cultivation, to which I shall direct the attention of the reader.

Although this question appears to be allied to that of the transmutation of plants, there is this difference between the two cases,—that while we have good ground to believe that the turnip derives its origin from the rape, of which it is considered by botanists to be an improved variety, we know so little of the natural, and especially the ancient, history of the cereal plants, that we have absolutely no data on which to depend, in order to account for those remarkable changes or transmutations that have been observed, and some of which were stated in my paper in the number of this Journal for March 1862 (p. 320). In my opinion, the only conclusion we can come to on this latter subject is, that the cereal plants are all closely allied to each other; but whether oats derive their origin from rye, or rye from oats, or whether barley may not be the parent or offspring of either or both, is a question that never can be determined, because there are no facts whatever to guide us in forming a safe conclusion.

With regard to the general question of transmutation of plants or seeds, there are but few authentic records of an early date. The first I have been able to find is in Gerard's 'Herbal,' and is as follows:—"I think it a very fit thing to add, in this place, a rare observation of the transmuting of one species into another in plants, yet none that I have read have observed it. Several grains, perfect in each respect, of oats, did grow at one time in an ear of wheat, the which I saw this year 1632, which was found by my very good friend Master John Goodyer, a man second to none in industry in searching plants, nor in his judgment and knowledge of them. This ear of wheat was as large and as fair as most are; and about the middle thereof grew three or four perfect oats in all respects, which being hard to be found, I held were worthy of setting down, for some reason not to be insisted upon in this place." *

* Gerard adds the following:—"It has been observed in ancient times, as by

According to Gerard himself, then, this was the first case of transmutation that had been recorded or noticed, to his knowledge ; and therefore, trifling as it may appear, I have thought it worth stating. At that period root-crops had not been generally introduced into field-culture, and not long into gardens ; whilst the little observation that had been given to vegetable physiology, and, above all, the universal ignorance of husbandmen of the nature, origin, and habits of plants, accounts for the deficiency of information to be gained from the early writers on the subject.

The next writer I shall refer to is Miller, who, in his 'Gardeners' Dictionary,' mentions the case of a market-gardener, near London, who brought an action against another, for selling him some seeds of a particularly fine cauliflower which he grew himself, but which, when sown, produced nothing but common cabbage. A verdict was returned for the plaintiff, the judge himself observing, in his charge to the jury, that "if the man purchased and paid for cauliflowers, it was only just that he should recover damages, when the seed produced only common cabbages that were so inferior in value." Miller, however, ascribed the change to hybridising, and cautioned the gardeners against growing for seed different plants of the same family or genus, on account of the danger of their being inoculated mutually by the farina.

Towards the close of the eighteenth century, science had begun to find its way into the agricultural class, or at least amongst the more enlightened portion of it. In Varlo, whose work on agriculture was published in the year 1774, we find the following observations :—Speaking of what were called turnip-rooted cabbages, he says, "They are known by what is called 'a bad appling turnip,' or one that does not turn out well, and I have many times weeded them out of my crops as being of an inferior sort ; and this has been mostly the case with all farmers. I always looked upon such plants to be the sport of fortune or chance rather than of nature ; however, I am inclined to think that both nature and chance are concerned in giving them an unkindly turn ; because I have sorted the seed and sown it separate, and found that it *mostly* produced turnips of the same shape, though not *altogether* so : for by the great chance that we find a bad-turned or parsnip-shaped turnip grow amongst seed that has been carefully transplanted and saved from turnips which were of a handsome, round, and flattish shape (for of such, choice is always made for seed), by the same chance, I say, we may find a handsome well-turned turnip amongst this bad-turned kind. . . . In short, one of these turnips bears the same affinity to the handsome, round, well-turned turnip, as a scallion

Theophrastus, 'De Caus. Plant.,' lib. 3, cap. 6, wherein, amongst others, he mentions the change of spelt into oats ; and by Virgil in these verses—

'In furrow, where great barley we did sow,
Nothing but darnel and poor oats did grow,"

does to a handsome well-turned onion ; for though onion-seed be all saved from a well-turned onion, and sown on the same ground, *yet some will produce good onions and some scallions*. I am apt to think their degeneracy from the turnip arises nearly from the same cause as does that of a scallion from the onion."—See Varlo's 'New System of Husbandry,' vol. i. p. 131-3. The above remarks show, that at that early period of the turnip's history, deterioration and change of species had begun to manifest themselves. We cannot, therefore, wonder that this should be the case, when so many new varieties have been introduced, by which the tendency to hybridising is necessarily increased.

Ray, in his 'History of Plants,' mentions a case in which one Richard Baal, of Bramford, sold some cabbage-seed to the London gardeners, as of an excellent kind ; but unluckily, when sown and cultivated by them, they produced an exceedingly bad kind. The consequence was that the man was prosecuted in the courts of justice at Westminster, and sentenced to return the money he had taken for the seed, and also to satisfy his customers for their waste ground, loss of time, and labour. Dr A. Hunter, in his 'Georgical Essays' (vol. iv. p. 138), refers to this case, and adds, "though, in fact, he was not at all deserving of such a sentence, not having had the least design to impose upon them."

Forsyth, in his work on agriculture, published at the beginning of the present century, makes the following observations on the subject of the deteriorating tendency of the turnip plant:—"For a few generations," he says, "the size of the bulb will keep pace with the increase of leaves and fibres (of the roots); but after having once reached the limits which nature has set to its magnitude, *it begins to revert to its original state of wildness, from which, to its present state, it has undoubtedly been raised by transplantation*. The farmer has therefore two extremes to avoid. The one is discoverable by the thickness and coarseness of the neck, the scaly roughness of the bulb, the thickness of the rind in general, the foulness of its bottom, and the forkedness of its main or tap-root ; the other by the slenderness of the neck, the fineness of the leaf, and the delicacy of the root." *

I have given the foregoing passages from these eminent writers in order to clear the ground before me, by showing that the tendency to change and deterioration had not escaped their notice ; and that, instead of throwing the onus of the failure upon the seed and the seedsman, they took the common-sense view of the case, and ascribed it to the true cause, which gives them a direct bearing upon the cases that have recently come before the public in Ireland. It is, in fact, chiefly in that country that the deterioration of the turnip, and more especially the Swedish

* 'Theory and Practice of Agriculture,' vol. ii. p. 588.

turnip, has most prevailed; and it would appear, from the testimony of the most competent and intelligent persons, that many circumstances have concurred to produce the result. Whilst in a large part of Ireland there is something in the soil and climate inimical to the turnip plant, the land, on the other hand, is in many parts so indifferently cultivated, and especially for the turnip crop, that it is no wonder if that crop sometimes proves a failure. I have myself frequently seen, when travelling in that country, fields of turnips, the owners of which never intended to hoe them; and when asked the reason, alleged that "sure they would grow together better without it, and that it would spoil the crop." Even when they were not quite so much behind in their husbandry, hoeing is frequently neglected till it is too late to obtain good-sized bulbs, whilst they are sown and left so thick that the bulbs cannot swell. When the natural tendency of the turnip to return to its original condition is thus encouraged by bad cultivation and an unkindly soil, no one need wonder that deterioration should be the result. According to the evidence of several persons who have been examined from time to time, the most careful selection of seed and culture of the plant have not been sufficient to insure a good crop. What, then, must be the effect when every rule of good turnip-husbandry is outraged, and the plants are neglected till it is too late to obtain a fair crop?

This deterioration has been the cause (as is well known) of several trials in Ireland; the first of which, I believe, was that of the action brought against Messrs Toole and Mackay, seedsmen, of Dublin, in the year 1854. I am not aware how the trial ended, but, from their letter to the editor of the 'Irish Farmer's Gazette,' I conclude that the verdict was against them. Be this as it may, the evidence at the trial proved, not only that the seed with which the field in question was sown was genuine Skirving's purple-top swede, but a clergyman who was called by the defendants stated that he purchased some of the same seed—that he sowed it in two different counties—and that in one it produced as fine a crop of swedes as could be wished for, whilst in the other it produced hardly anything but "rape-like plants;" and the same contrary results occurred with other persons who purchased the same seed.

This tendency in the Swedish turnip to go back to its original state had been observed for some years previously, and, in fact, had always existed from the first of its introduction, but recently it had increased. In the same journal (the 'Irish Farmer's Gazette'), for December 19, 1863, is a letter from Mr D. Moore, Conservator of the Botanic Gardens at Glasnevin, Dublin, which throws considerable light on the subject. Mr Moore shows that the original parent of the common white turnip in all its varieties was the *Brassica napus*, and that of the swedes *Brassica campestris*. There is no written record of the time or the manner of this change, but it must date farther back than the Christian era, for both Pliny and Colum-

ella speak of the turnip as cultivated in their time; and what is more, their writings also throw considerable light upon the question in hand; for they speak of two kinds—the turnip, which was a globular bulb, sometimes weighing *more than forty pounds*—the other the *navew*; and the following is the account given of them by Columella:—“After pulse, we must take *navews* and turnips into consideration, for both of them fill the bellies of rustics. Nevertheless, turnips are more useful, because they both yield a greater increase, and they are food not only for man but for oxen also, especially in Gaul, where this kind of root affords nourishment for the aforesaid cattle during the winter. Both of them require a rotten, crumbling, loose soil, and don't grow in thick, close ground; but turnips thrive best in open plains and moist lands. The navew loves land that is shelving and dry, which comes nearer to that which is lean and poor, therefore it grows better in gravelly and sandy lands; *and the quality of the place changes the seeds of both the one and the other; for, in a different soil, in two years' time turnips are changed into navews, and navews assume the likeness of turnips.* . . . They require ground that is well tilled, over and over again, either with the plough or the spade, and satiated with plenty of dung. There must not be more than four *sextarii* (rather more than four pints) of turnip-seed sown upon one *jugerum* of land or (27,849 feet); and a fourth part more of navew-seed must be scattered upon a *jugerum* of land, *because it doth not spread and enlarge itself into a broad belly, but strikes its slender root downward.*”* Thus, according to this writer, who lived and wrote in the first century of the Christian era, the tendency of the Swedish turnip and the *napus* (for the navew was neither more nor less than *napus*, according to his description of it) to be transmuted the one into the other, was well known. The italics are mine, and I use them to direct the reader's attention to the most salient parts of the passage.

To return to Mr Moore's letter: he considers the *navew* to be the wild origin of the Swedish turnip, and says they are worthless weeds in their wild state. This does not accord with the writings of either Columella (as above) or Pliny, or the Greek writers either, for all of them speak of it as a cultivated plant, much in use both as a culinary herb and as cattle food. In other respects Mr Moore's observations agree both with recent facts and with the accounts of ancient authors. “The degenerating of individuals among our crops of turnips,” he says, “is simply an effort produced by the plants following a natural law inherent in their constitution, to return to the typical state. As has been noticed by Dr Lindley, in his theory of horticulture, all our root-crops have undergone, at some period of their history, a similar selecting and improving; and if cultivation were suspended during a series of years, they would revert

* Columella on Husbandry, chap. x. p. 79.

back to the forms of the wild plants they originated from. The history and origin of many of the present improved varieties of swedes is better known, and in some cases recorded. They have, however, all been produced in strict accordance with physiological laws, either as *hybrids* between two species, or cross-bred between two varieties, or natural selection in the sporting of swedes. It was known to be a general law, though not altogether without exception, that those fixed varieties will continue to produce their like, from carefully selected seed, with the tendency to return to the original wild form, if otherwise treated; but surely, seed selected from the swede progeny will never produce rape nor borecole.”*

We shall now revert to the two trials that took place last year,—one in Dublin, the other in Cavan. The first was an action-at-law against Mr Berry, a respectable seedsman in Dublin, for selling seed professing to be that of swede turnip, and *warranted* to be such, but which produced a mixture of turnip and rape. The question turned entirely upon the warranty, and the judge ruled that, as the seed was warranted to produce swedes, and did not produce them wholly, but mixed with other plants, the verdict must be for the plaintiff; and the jury returned a verdict accordingly.

The case tried at the Cavan Quarter Sessions was exactly similar in its features, except that no warranty appears to have been given. There were several farmers of the district who sued; but it was agreed that the verdict in one case should rule the whole of them. The chairman, Joshua Clarke, Esq., Q.C., candidly declared that he was quite ignorant of the nature of the case, and wished to have the assistance of some practical gentlemen; on which a jury of three was selected—namely, Messrs Rielley, Nesbitt, and Meikle. The plaintiffs proved purchasing Swedish turnip-seed at the shop of Kennedy, the defendant, which produced a plant exhibited in court, and which was more like the *kohl-rabi* than the swede that it should have been. Some evidence having been adduced on the part of the defendant, the chairman thought it would be more satisfactory for the jury to examine some of the crops, as they would then be better able to form an opinion than from any evidence; but Mr Armstrong said he had a scientific gentleman in court, to whom it would be inconvenient to remain in the town, and he therefore wished to be examined at once. This being acceded to, D. Drummond, Esq., seedsman, of Dublin, was then sworn and examined by Mr Armstrong.

In the course of his evidence, Mr Drummond went into the history of the Swedish turnip, which, as has been shown, was originally

* The passage from Columella, if, as there is every reason to believe, it refers to what is called the Swedish turnip, takes from the Scandinavian kingdom the claim to be the native country of that plant, although *we* may have derived it from thence; it being hardly likely that the Romans were indebted to that northern country for the turnip or anything else of vegetable produce.

derived from a species of rape, as the parsnip and carrot are derived from weeds of the same names; and that, under certain circumstances of soil, weather, and cultivation, there is a constant tendency in the plant to "sport" (as it is technically called by gardeners), or go back to its original wild state. This, too, is the opinion of botanists of the first ability. The cause of this is unknown; but so fickle is the swede in this respect, that the utmost care in planting selected bulbs for seed is not sufficient to prevent a deterioration; and seedsmen of the first character for the goodness of their seeds are frequently baffled by having them produce plants of very inferior quality. "He had seen seed which he knew to have been grown from large selected bulbs produce chiefly rape-like plants when sown on one day, while the remainder of the seed, out of the same bag, *and in the same field, two days after, gave as fine a crop of swedes as could grow*, and entirely free from sporting plants. Saw in the county of Wicklow, on one of the best cultivated farms, a field of twelve acres, where the ends of about twenty drills gave only rape-like plants, extending to about twenty yards in the field, while on the remainder of the field was an excellent crop of bulbs. And again, in Tipperary, where there were two fields separated by a hedge and ditch, the hedge was thrown down, and the field sown with swedes. On each side of the levelled ditch was a crop of excellent bulbs; while over the ditch, almost every seed grew to rape-like plants. Saw a field last week in Carlow, where there were a considerable number of rape-like plants, although the seed was grown by the gentleman himself from large selected bulbs; and another grower of his own seed, who sows extensively in Ireland, had almost a lost crop a few years ago from the non-bulbing of the plants. It is well known that carrot and mangold sown on one farm will produce a large proportion of plants that do not bulb; while seeds sown from the same bag on another farm, will yield crops entirely free from such 'starters;' but the cause cannot be accounted for any more than we can account for the swede going wrong. Grows the most of his swede-seed in Scotland, in the most careful manner from the purest stocks, and still has had complaints similar to plaintiff's. Could not be by hybridising with rape when in flower, because rape is not grown in Scotland. His seed could not have been accidentally mixed with rape; for to avoid such an accident, he keeps his rape and turnip seed in separate warehouses, and each bag has the name plainly printed on it. Has taken alarm at the frequency of late years of the 'sporting' of the swedes; so much so that, to protect himself from liability, he two or three years ago consulted counsel on the subject, and, following counsel's advice, got a non-guarantee notice printed on all his bills. In fact, so annoying and troublesome has it become, from the uncertainty of the swede-producing bulbs, he has been seriously thinking of giving up that branch of the trade."

The evidence of the defendant himself was important in support of his case. He stated that he only sold one kind of turnip-seed, and therefore it was quite impossible that rape-seed could be given for turnip, as there was no such a thing in his establishment. He had sold 220 parcels of the seed in question; and when he heard of the seed producing plants like the one in dispute, he deemed it advisable to visit the farms of the parties and inspect the crops. He discovered on all the farms of those complaining, that the crop was sown too thick, and the cultivation neglected. It was only on the wet parts of the fields that a plant like the one produced grew; where the seed was carefully cultivated, an excellent crop of turnips was the result. The same seed grew good turnips for Mr Telfer and Mr Lamb, and for others who used proper care in the cultivation. Overtures were made to him to settle the cases, which he declined to do on principle. Mr Telfer confirmed the defendant's statement in regard to the imperfect cultivation of the fields on which the rape-like plants grew, and he considered Mr Drummond's explanation correct. In 1851 he himself sowed the same description of turnip-seed in the counties of Limerick, Cork, Clare, and Tipperary, and in the two former counties a good turnip crop was produced; while in the two latter counties a plant of a hybrid character, similar to the one in dispute, grew. A plant like that produced might grow from the purest turnip-seed, and side by side with Swedish turnips, &c.

An important feature was elicited by the evidence of Mr Drummond, which is, that the supposed spurious plants or rapes had most of them *purple stems*, the same colour as the turnip—the purple-topped—from which the seed was produced, which proved their paternity, because the common rape has a green stem, and in no case a purple one; and where the green-topped turnip-seed was sown the rape-like plants had green stalks. The evidence in favour of the defendant was so overwhelming and conclusive, especially that of Mr Drummond and Mr Telfer, that his worship, the chairman, confessed it had altered his first impression—that if the article sold by Mr Kennedy was commercially known to the trade as turnip-seed, he could not then be held liable; but if it was not so commercially known, his liability was clear, &c. The jury, after a short deliberation, found a verdict in favour of the defendant, and dismisses were obtained against all the plaintiffs.

This trial, and the important evidence it brought forth, will undoubtedly rule in any future case that may be brought forward; which, however, after so conclusive a defence and result, we do not expect to hear of. In the 'Irish Farmer's Gazette' of November 7, 1863, were some excellent observations on the subject of these trials, which we shall transcribe. In reference to the action against Toole and Mackay, the editor remarks:—

"It does appear that the seed vended was part and parcel of a much

larger quantity, and that, though some of the seed given the plaintiff did not bulb when sown, but prematurely started to seed, the same seed sown in various other localities, according to the defendant's showing, exhibited no similar results. Now, every practical farmer or gardener, whose opinion is worth anything, knows that such things happen every year with all the biennial plants in cultivation. All those plants, such as mangold, carrots, turnips, parsnips, cabbages, cauliflowers, broccoli, &c., are the improved progeny of normal plants, produced by cultivation and accident, and have a tendency to return to their original types; and this is increased by removal to particular soils, climates, &c. There is not a field we enter but this may be observed in some shape or other, even when the seed has been the most carefully selected. In purple-topped swedes we shall find all shades down to a green-topped, and in other species similar 'sports.' By a freak of nature we get those valuable varieties, and by similar freaks new ones come into us every season—all caused by some undefined, mysterious, and subtle influence of the atmosphere, soil, or climate.

"Nine years have passed, and rape-like plants still appear in spite of every precaution; and seedsmen might as well be called upon to compensate their customers who suffer from potato disease, as to incur the responsibility of a crop, of which a considerable proportion may have sported from some cause or other, over which they do not appear to have the slightest control. Respectable seedsmen, who look upon their customers' interests as identical with their own, will of course, for their own sakes, use every means to secure genuine seed, just as they have hitherto done; but they will, at the same time, adopt the precaution taken by Mr Drummond, and while they supply as carefully selected seed as they can procure from the best stocks, they will not guarantee any of them, so as to incur the responsibility in case of sporting; for it must be observed, that neither in the case which Messrs Toole and Mackay complained of, nor in that of Goff v. Berry, nor in that which was tried in Cavan, was it ever asserted that the strange plants were rape, and therefore likely to have come in consequence either of accidental or wilful intermixture; but that they were plants like rape—'rape-like plants'—sports, in short, of the swede turnip, for which no seedsman can be accountable; as such sports sometimes occur even in the produce of the most carefully-grown seeds."

In the 'Irish Farmer's Gazette' of January 2 in the present year, some cases are brought forward in strong confirmation of the conclusion to which all rational and disinterested persons who have studied the subject have arrived at. The following is taken from the article, and powerfully illustrates the erratic character of the swede turnip:—

"Having learned from Mr Anderson that a portion of his crop of swedes at Levittstown, in the county Kildare, had not turned out as he expected it would do, and that it presented some features which would probably be interesting in connection with the 'turnip question,' we recently proceeded to examine his crops. It is necessary to state that Mr Anderson has been in the regular practice for many years of growing his own turnip-seed from selected plants of one kind, and that he has given this part of his operations very close attention. It is almost unnecessary to state that he is in all respects a most skilful and painstaking farmer, and that he gives his crops every justice in all respects. We mention this in order that there may be no suspicion that defective cultivation has anything to do with the appearance which certain portions of Mr Anderson's turnip crops have exhibited this year.

"One field at Levittstown, containing 24 Irish acres, was entirely under

swedes this season. The variety sown was the improved purple-top, grown, as we have said, from seed saved by Mr Anderson from selected bulbs. The soil is a good loam, full of limestone gravel. The manures used were entirely artificial—namely, Peruvian guano and superphosphate, in equal proportions. On several acres on both sides of the field the swedes are not over-large in point of size, but equal—perfectly globular, and true in point of colour; that is, they are altogether purple-topped, and at the same time perfectly sound. On five or six acres in the middle of the field the swedes are of an entirely different character. A slight tinge of purple may occasionally be observed at the base of the stem, but the prevailing colour of the top part of the bulb is green—so much so, that on submitting a specimen of the bulbs to the inspection of several practical men, they at once pronounced it a green-topped swede. This, however, is not the only point in which there is a difference. The swedes grown in the middle of the field, instead of being globular, are coarse, forked, and have more of a fusiform character than we usually find in swedes. One of these turnips now lying before us is almost wedge-shaped, and it is altogether a much finer specimen than most of the others of the same kind. We ought also to state that most of the deformed bulbs are unsound.

“So marked is the difference between the bulbs grown on both sides of the field, as compared with those grown in the middle of the field, that if Mr Anderson had got the seed from a seedsman, and had chosen to go into court with a claim for damages, we have scarcely a doubt that he would in all probability have obtained, with ordinary juries, a verdict in his favour. But he had grown the seed himself; there was nothing wrong with the plants that produced the seed; and that it was true to its kind is proved by the fact, that on three-fourths of the entire field—that is, the two sides—the bulbs grown were all right and satisfactory; consequently the diversity in the bulbs is evidently attributable to some other cause than mixed seed. We may therefore put mixed seed, and even the possibility of it, out of the question, for there was only one kind of seed grown by Mr Anderson; and even supposing it had been mixed by some unknown means, how could it happen that the green-topped deformed plants should have occupied but one part of the field, when all the seed was taken out of the same bulk? If spurious seed had been mixed with the rest of the seed, the spurious plants must have come up all over the field, and not been confined to one spot.

“Now, there is a circumstance in the history of the cultivation of that field which so far throws some light on the subject. Mr Anderson entered upon possession of Levittstown on the 17th March 1854. He had been accustomed, while farming in Scotland, to lime extensively, and wishing to try the effect of lime on the soil of his new farm, he limed some portions of it, among which *was the middle of that very field* where the crop of swedes to which we are alluding was grown this year. The two sides of the field were not limed. The deformed, unsound, green-topped turnips were only found on that part of the field that was limed. Hence it is but reasonable to suppose that the application of lime to a soil already abounding in calcareous matter has proved detrimental to the health of the turnip crop, although six years must have elapsed since the hot lime was applied. Hitherto the application of the lime did not appear to have exercised any influence either for good or evil on the intermediate crops; but this year the results have been so marked, that there can scarcely exist a doubt that the liming has been ultimately injurious.”

This remarkable case, which is strengthened by the result in another of a similar kind on the same farm, although it may differ in some of its features from those in the counties Cavan and Dublin, is conclusive on the *one* point on which rests the question of the

liability of the seedsman—namely, the decided tendency of the turnip, and particularly of the swede turnip, to revert to its original character of rape or napus (or *navew*, as the ancients called it) under various conditions, some of which, like the one just quoted, are well and strongly defined, whilst others are involved in mystery; but all of them are sufficiently characteristic to clear an honest seedsman from responsibility. As justly might a farmer claim compensation for the disease in a crop of potatoes from the person of whom he purchased the seed-tubers, though there might be no appearance of the disease upon them. We should expect that, after the light that has been thrown upon the subject by the evidence adduced on the late trials, and since, in the public prints, no seedsman will henceforth venture to give a guarantee with turnip-seed, or fail to announce such a resolution at the head of his bills; for it is evident that in future, when such actions are brought into court, the question of damages must turn solely upon that of a guarantee; and if none is given, no responsibility can be adjudged.

There is another circumstance connected with the cultivation in Ireland of a totally different character from this tendency of the turnip to “sport,” but which probably has been the cause of the mixture of true rape in the turnip crop,—I allude to the practice of growing *rape-seed* in that country, and afterwards laying the land down with grass. Now, it is impossible to grow rape-seed without having a portion of the seed shed at the time of harvesting it; and this, if ploughed in immediately a certain depth, would not vegetate, but, at the same time, would remain in the ground any length of time without losing its vitality. This property of lying dormant in the soil is common to the seeds of all the Brassica family of plants; and as the growth of rape-seed is common in Ireland, it is no stretch of fancy to suppose that a part of the seed is buried under grass, to be brought into life and vitality when the land is again broken up and sown with turnips or other crops. That such has been the case in some instances, the editor of the ‘Irish Farmer’s Gazette’ proved almost to a demonstration, by the appearance of rape all over fields of swede turnips where rape had been cultivated some years previously. It appears to be a common practice to lay a field down with grass in a crop of rape or cole seed; and those seeds that are buried too deep to vegetate will be prevented from doing so afterwards by the grass, which, of course, requires the land to be left undisturbed until the grass is broken up. Although this has no bearing upon the question of “sporting” or deterioration, it is right that the practice of this growing of rape-seed in Ireland should be known, as it will account for the appearance of the plant on such lands.

Another cause, however, of deterioration is over-manuring. I have myself frequently seen rape-like plants growing on the site of dung-hills in turnip-fields, and I believe it to be a very common occur-

rence that the turnips will not bulb in such situations, or if they do, the bulbs will be unnaturally large and coarse; but in a general way they will throw up a tall stem as if running to seed, which in fact they would do but for the approach of winter. This tendency was pointed out by Mr Milne, land-steward at Townley Hall, Drogheda, in a letter to the editor of the 'Irish Farmer's Gazette,' Dec. 9, 1863, who, in a small field of not $4\frac{1}{2}$ acres, found that on the place where the dunghill was set, the turnips threw up tops like rape, with stems as large as those of a cabbage, and roots about the size of carrots. On the whole space of about 20 yards by 11, not a good-sized bulb was to be seen, and it extended exactly to the edges of where the dung-heap stood, and nowhere else; and this was the case also on a hollow that had been filled up with mould and other rubbish, causing a great depth of soil. On this the turnips were just as bad as on the site of the dunghill.

I have now endeavoured to trace the history of the turnip plant, and its tendency to revert to its original state of wildness, from the earliest ages of which any record of it has descended to us up to the present time; and also of the causes, or probable causes, so far as they have been discovered or surmised, of this deteriorating tendency. This question more particularly concerns the farmers of Ireland, because, in entire ignorance of the natural history of the turnip, they have thought themselves aggrieved by being supplied with bad seed, and have sought, and in some cases obtained, heavy compensation for the loss of crop, when the seedsman was entirely innocent of any share in causing it. Several of the seedsmen, alarmed by the prospect of having to defend a series of actions-at-law, have, at a heavy sacrifice, compromised the cases alleged against them,* when, in point of fact, the farmers themselves, in some instances, were wholly to blame in not having properly cultivated the ground; whilst in others the causes were too occult to be defined. The instances I have brought forward, and the evidence adduced by men of the first respectability and intelligence, well acquainted with the subject both in a scientific and a practical point of view, are sufficient, I flatter myself, to convince any reasonable man that this is the case; and it is to be hoped that after so much light has been thrown upon the subject, that we shall hear of no more prosecutions, being quite sure that no jury of any intelligence would give damages unless a case of fraud could be made out. Doubtless there are fraudulent seedsmen as well as of other trades; and these tempt the farmer with a cheap article, which in the long-run proves the dearest, because it is worthless. We believe, however, that when rape-seed is mixed with turnip-seed for the sake of reducing the price, the vegetating principle is always destroyed, either by scald-

* We could name one house in London that thus paid £1000 in one season as compensation.

ing it with boiling water or high-drying it upon a kiln, so that it cannot grow.

It is worthy of remark too, that, in the Cavan trial, the whole weight of evidence was in favour of the defendant Kennedy, the only really important witness for the plaintiffs being Mr William Reid, Scotch farming-steward to Mr Humphreys of Ballyhaise. This man could only say he did not consider Mr Drummond's explanation of the case the right one; but he did not allege any better reason; and he admitted that Mr Drummond was a most experienced man in the seed-trade, and that his view of the case *might* be the right one. This evidence, therefore, was utterly worthless, and was evidently considered so by the court as well as the jury. I shall now sum up, and recapitulate the various facts that I have endeavoured to prove in this paper, as follows:—

1st, That the turnip plant, in all its varieties, is considered by naturalists to have been derived by cultivators from different species of rape.

2d, That there is a constant tendency in the plant to revert to its original state and character of rape.

3d, That this tendency has been known, observed, and recorded by agriculturists from the earliest ages, especially by those eminent writers of the first century of the Christian era, Pliny and Columella.

4th, That this tendency in the turnip plant to degenerate, or revert to its original condition of wildness, is promoted by various causes, as—

- (1.) By imperfect cultivation and want of draining.
- (2.) By the soil being either too poor or too rich.
- (3.) By sowing too thick.
- (4.) By the neglect of hoeing till it is too late for the plants to bulb properly.
- (5.) By the improper use of lime in a caustic state.
- (6.) By various causes of soil, climate, atmospheric phenomena, &c., too occult to be defined, but which are supposed to operate injuriously, particularly in Ireland, where this tendency of the turnip to "sport" is more prevalent than in England or Scotland.

5th, That seed produced from the most carefully-selected and transplanted bulbs are not sufficient to insure the crop against deterioration or "sporting," to a greater or lesser extent.

6th, That therefore to sue for damages against a seedsman, with no better proof of fraud than the simple fact of deterioration, is unjust, and can only be successful through the ignorance of both judge and jury of the character and history of the turnip plant.

RETROSPECTIVE NOTES ON FARM CROPS AND CROPPING.

No. V.

OF the cereal or white crops of the farm, Barley claims the place next in importance to the wheat; to the leading features connected with its cultivation we therefore proceed to direct the attention of the reader. In hunting up such scanty records as the generally meagre history of agriculture affords bearing on the early history of our farm crops, we find but little, and that little vague and uncertain, with reference to that of barley. As in the case of wheat, we find in the earliest records mention made of barley as an established crop, so that all is merely conjecture as to its origin, or by whom it was first introduced. The writings both of profane and sacred authors abound with allusions to it, showing the important place it occupied and the estimation in which it was early held. The Romans held it in high repute, and the Greeks especially so; but it is to the writings of the former people that we owe what we know as to its habits and the modes adopted for its culture in ancient times. The most marked general feature connected with barley is the wide range of climates in which it can be cultivated, in this respect taking precedence of all our cereal crops, for it can be cultivated, and successfully, in climates so cold and humid as to prohibit the growth of wheat, and in climates so warm and drouthy as to prevent the cultivation of the oat. Barley, therefore, is an important cereal; but it is not only marked for the wide range of climates in which it can be grown, but also for its adaptability to high regions, placed at an elevation considerably above that at which wheat can be grown.

Barley belongs to the class of monocotyledonous plants, the sub-class *glumiferae*, order *graminae*, and the genus *hordeum*. The following is the generic description of the plant: "inflorescence spiked; spikelets are flowered three together, the two lateral often barren (as in the two-rowed barleys); glumes, two, equal, opposite, so small as to resemble short awns or bristles; paleæ, two, the lower one bearded, the upper with two keels; scales, two; stigma, feathery; seed surrounded by the paleæ." The number of species, and the varieties of each species, is by no means a settled point. Professor Wilson inclines to believe that Gasparin's classification of two species, the two-rowed (*Hordeum distichon*), and the six-rowed (*Hordeum hexastichon*), is the one which is botanically correct. Professor Lindley maintains that all the so-called species or varieties which some authorities, as Kunth, reckon up to as many as fifteen, are but variations of the original type, and this, he says, is the "two-rowed," or what is called the "common barley." Of this genus, the original type of all the barleys now grown, he says, the spikelets always stand in "threes, and the threes being placed back to back,

it is evident that every ear of barley must consist of six rows of spikelets. If the middle spikelet of each set of three is alone perfect, the side spikelets being abortive, we have the common two-rowed barley (*Hordeum distichon*) and its many varieties. If the two lateral of each set of threes are perfect, and the centre spikelets imperfect, as sometimes happens, we then have the four-rowed barley; if, on the other hand, all the spikelets are perfect, we have the six-rowed barley, but the case of the four-rowed barley being merely accidental, they may be referred to the six-rowed form, and then we have only two principal kinds of barley, the two-rowed (*Hordeum distichon*) and the six-rowed (*Hordeum hexastichon*).” In Scotland, however, the four-rowed barley is so much grown and known under the name of “bere” or “bigg,” that it seems necessary to include this as a species, under its botanical name, *Hordeum vulgare*, although this kind is rarely grown in the southern districts of the kingdom. The following is the generic description of the three species named above, beginning with the *Hordeum vulgare*. “Florets all hermaphrodite; fertile, middle grains on each side forming a distinct straight row, lateral ones forming a kind of double row towards the base, but uniting so as to form one row towards the extremity of the spike.” The different parts of “bere” are proportioned as follows, the grain nearly 51 parts out of the hundred, the awns nearly 6 parts, the straw nearly 38, and the roots nearly 5½ parts. The varieties named by Mr Lawson are eight in number, (1) common “bear,” “bere,” or “bigg;” (2) square barley; (3) white winter barley; (4) African, Tangier, or Morocco barley; (5) Bengal barley; (6) black winter barley; (7) naked Siberian barley; (8) Nepaul or Himmalaya barley. Some of these are not now cultivated. The following is Professor Wilson’s classification: (1) black four-rowed; (2) Victoria bere; (3) winter white; (4) Peruvian. Of these the Victoria is probably the finest. “The straw and ear are longer and stouter than the common bere; the grain is much heavier, weighing up to 54 or 56 lb. per bushel; and the produce is much larger, from 10 to 12 quarters having been obtained to the acre.” Peruvian is a naked barley, of which Professor Wilson says, the characteristic seems to be that they “are not so well suited for our climate as the ordinary barley,” thriving “best where a short but hot summer enables them to carry on a perfect and rapid growth.”

The following is the generic description of the *Hordeum hexastichon*, or six-rowed barley:—“All the florets hermaphrodite and awned, seeds placed regularly in six rows; . . . has a much thicker spike than common or spring barley, but is also much shorter; the number of grains, however, in an ear or spike is greater, in proportion of at least three to two. The ear is seldom more than two inches in length.” The species is hardy and prolific, but yields the coarsest sample of all the varieties grown; the grains

are long, ill filled, and the awns adhere to them with much tenacity. It is not much grown in this country, but when grown it may be either as a spring or winter barley, it being found to answer for either one or the other. There are no varieties of this species. The ripening is late, a fortnight or so behind other kinds. The proportions of the parts of this species are as follows:—Grain, 51; roots, 12; straw, 32; awns, 5 in the hundred. The third species yet to be noticed, *Hordeum distichon*, the common two-rowed barley, has “ears in general three to four inches long by one-third of an inch broad, containing 28 or 30 grains, which are not very close set on the rachis; awns extending about the length of the spike beyond its point.” Mr Lawson names of this species seven varieties—(1) Chevalier, (2) Annat, (3) Dunlop, (4) Stain’s, (5) Golden or Italian, (6) Chancellor, (7) Russton. Mr Keary, in his ‘Prize Essay on Barley Management,’ of which further notice will be taken hereafter, says that, of all the varieties of barley, Chevalier decidedly ranks highest for malting purposes. To the objection that it does not yield so much per acre as other varieties, he states that, under proper cultivation, there are few sorts to be compared with it, and gives the following results of three sets of experiments on the value of some varieties of barley, which show that in every year Chevalier had the precedence of quality:—

	In 1836.	CORN.		STRAW.		
		Bush.	Pecks.	Tons.	Cwt.	Lb.
Chevalier,		42	0	0	14	1
Common Barley,		42	0	0	15	6
American,		40	0	0	14	4
In 1841.						
Brewers’ Delight,		57	1	1	6	6
Berkshire,		56	2	1	6	2
Chevalier,		60	1	1	7	6
Nottingham,		56	3	1	8	0
In 1845.						
Brewers’ Delight,		52	0			
Chevalier,		48	8			

Although these are retrospective notes, and are therefore not limited, as they are not designed to be limited, in point of retrospective *date*, still some may be inclined to think that, in these so-called advanced days of agriculture, we should have presented a detail of experiments coming nearer our own time. Not here to find fault, however, with the somewhat scanty evidence which our recent agricultural literature presents of the efforts of advanced agriculturists to give us trustworthy data upon all cultural points—evidence so scanty that in truth we can give no later experiments, seeing they have never been made, or apparently never thought of—what we wish now to draw attention to is this, that the investigation of the records of past, and what may be called old, nay, very old, experience, are really most prolific in useful information on all *cultural* points. We are sure that

those who, like ourselves, have searched far back the annals of agriculture, must have been struck with this fact, that the majority of cultural points are discussed so fully and suggestively that nearly all that has been written of late years seems but an echo or repetition of them ; and not only this, but that many of the novelties, so called, of to-day were *pres shadowed*, and not only so, but in some cases described and fully discussed, in these early records of agriculture.

The following, from Mr Fyfe's paper in the 'Journal of the Bath and West of England Society' on "Farm Seeds and Seeding," on the subject of barley seeds, will usefully conclude this part of our subject :—

"The practical procedure in regard to barley, then, runs thus—the Chevalier, the Thanet, and the common barley ; the recommendation of the Chevalier consisting not only in its popularity with maltsters, but in the fact of its tall stout straw not being liable, in the general experience, to lodge, and even when it does lodge, not being subject to after-shoots of germ, although one of our correspondents reports otherwise. The great fault of the common barley is its liability to over-luxuriance, and to shank over at the knee when too richly manured. When grown on warm friable soils, or even when deeply deposited in a tilthy bed, it is best adapted for succeeding turnips and for being eaten down by sheep ; but for that matter, so also is wheat, which, of all crops, loves a hard-pressed surface. One of our ablest correspondents states, however, that he has of late years grown wheat after all his root crops and barley, which he seeds down after his wheat. By pursuing this system he grows first-class barley, and insures better and more healthy crops of seeds and roots."

Mr Keary is a strong advocate for a "constant and *judicious change of seed*," and says that, "although it may sometimes be expensive to obtain it from a great distance," he believes that it "will generally repay the cost by an increase of produce and an improvement of quality ;" and he gives the following instance confirming his opinions on this point, which, we need not say, are those of the best authorities on barley cultivation :—

"On two adjoining farms in a barley-growing district, both much alike as to quality of soil, the occupier of No. 1 being in the habit of constantly changing his seed and sowing tolerably early, and the occupier of No. 2 systematically never changing his seed, and sowing rather late. The quality of the barley grown upon No. 1 in the year referred to (1836) was remarkably good ; and upon No. 2 it was so very inferior as to be quite unsaleable for any but the most common purposes ; and 2s. per bushel, or 16s. per quarter, was the difference in the price these barleys fetched, at several times during that season, on the same day and at the same market. The produce per acre, also, was, as nearly as could be ascertained, very much greater on farm No. 1."

So much for the question of the change of seed, upon which little further need be said than this, that if the trouble and slight expense involved by following the plan here recommended by Mr Keary and so emphatically endorsed by other authorities, be grudged

by the farmer, it is all the more imperative upon him to see that the seed which he does use of his own or his immediate neighbour's growth be of thoroughly good quality, clear in colour, with the ends in no way blackened, full and plump in shape. We have already passed a stricture or two upon the absurdity of using bad wheat for seed purposes; it is no less patent, nor, we regret to say it, less frequently done, in the case of barley. Indeed, it is altogether surprising, when we think of the "natural fitness of things," to see how careless many farmers are on this same point of "seed;" anything, with some, seems good enough for seeding: nor need the poorness of some crops, which a walk through almost any district in the kingdom will too readily show, be at all wondered at when we come to inquire into the nature and quality of the seed which has been used. It is worth while to remember, what is unfortunately too often forgotten, that *as the seed so the crop*, and that a vast deal of the cost and labour of the preparation of the land may be absolutely thrown away by the carelessness we may display in the choice of the seed which we commit to its bosom. With reference to the change or choice of seed, Mr Fyfe remarks—"As the foreign names of many of our barleys imply, the best change is considered to be from a distant and very different soil; and whether from an early to a late, or *vice versâ*, this sort of change is of vital importance. But it should be observed that the change of seed from an early to a late district is found to be the means of hastening the period of ripening, and of affording the chance of a finer quality of produce; whilst the change from a late to an early district will retard the time of ripening, but afford due time for perfect ripening. The very best quality of seed that can be procured should in any case be used."

Although what we have said as to the importance of having good seed if we require good crops is evidently founded upon correct principles, and is indeed the creed of the enlightened portion of the agricultural community, nevertheless, that a contrary opinion is held by some will not be wondered at by those who know how uncertain a thing agricultural practice is, and how far removed from the position of a fixed science it is (see remarks on this point in a succeeding page of this paper). But it is, notwithstanding, difficult to believe that one writing to an agricultural paper should give advice to others based upon such a principle as this,—“If you desire to reap a first-rate article, you must sow a second-rate article.” Evidence is then offered in support of what is called the “truth” of this extraordinary opinion, but into which we do not care to go. The writer has been taken in hand, and, to make a bad pun, ably handled, by the well-known writer, “The Old Norfolk Farmer,” of whose reply we have only space to give the following:—“But to be consistent,” the correspondent “should carry his principle out *à l’outrance*, as the French would say. Thus, in selecting his breeding cattle and sheep, he must re-

verse the practice of great men, and choose the most ill-shaped, raw-boned, half-starved animals he can find. 'What is sauce for a goose is sauce for a gander;' and if the principle is good in the case of wheat, it must be also in that of all other grain and seeds, and of animals as well." No more need be said. If this new view is right, all our scientific teaching is wrong, and nothing is left us but to begin again, and upon a new tack.

The *time of or period for sowing* the barley crop is another important part of its economy, and one to which the attention of the careful farmer is now more directed than ever. In many districts it is, as a rule, sown too late; and in connection with any crop it may be laid down as an axiom, the later the sowing the poorer the yield. The celebrated Arthur Young was amongst the first to point out the value of early sowing of barley; and the following is a statement of the results of some experiments of his to determine the point. Barley sown in February yielded 12½, in March 11½, April 8½, May 6½, in June 3½th. We have said the later the period of sowing the poorer the yield; this may, however, be taken with this reservation or addition—the later the period *after a certain date*; only it is difficult to name what this date is. Locality, climate, the peculiar nature of the season, will all bear upon the decision of this point, and, varying as they do, will of necessity introduce such disturbing elements into practice that it will be difficult to lay down a rule which will be applicable to all districts; nor, indeed, one which, if shown applicable to a certain district one season can be applicable in the same district at another season. In truth, in connection with this important point, as in fact with many other points of agricultural practice, little is left us but conjecture—by none of our agricultural societies has the determination of this question, by accurately comparative experiments, been taken up. Conjecture, however, is all in favour of early sowing—say, from the beginning of March to that of April, and all sowings after the latter date may in favourable districts be set down as risky. It would be well for the interests of agriculture if our Scientific Associations were to take up now and then the consideration of questions other than those which seem alone now to occupy their attention and engross their cares, and this to which we have now alluded might very usefully be made one of them. Mr Keary has some remarks on the "risks" as well as the "advantages" of early sowing, in which he adverts to what we have already drawn such marked attention—namely, the difficulty, or rather the "impossibility," as he puts it, of "fixing any period for sowing which will suit all circumstances and all seasons." If the weather is good and the land is dry and works well in February, early sowing will "unquestionably improve the *quality* of the barley;" but Mr Keary doubts as to the yield being increased. This, as will be noticed, is in direct opposition to the results of Young's experiments. Mr

Keary, however, distinctly states what all will agree with, "that it never can be judicious to meddle with the land in the spring till it is dry and works well." On strong cold land the sowing of barley should be earlier than when the land is light and sandy and the subsoil warm and dry. In the strong cold land there is no danger, says Mr Keary, of a "too rapid growth in the first stages, and the land having sufficient staple to carry it out, the quality of the grain will be improved and the period of cutting will be accelerated. On the other hand, if sown before the land is in proper tilth and fit to receive the seed, a rough coarse sample will be produced." As to *very late sowing*, Mr Keary states that its "invariable" result is an "inferior quality of corn." A great deal necessarily depends upon the weather in the choice of the period for sowing; but if success is desiderated, it is essential that the land at the time of putting in the seed must be in a favourable condition. What that is, is indicated by the saying that "in sowing barley the dust must rise after the harrows;" and yet this, like many other apparently decisive sayings, must be taken with reservation, for although the land should be dry, it should only be so relatively, for a certain amount of moisture in the soil at the time of sowing seems to be a necessary condition in insuring a successful braird. If the weather during the preparation of the soil has been so favourable as to admit of a fine tilth being secured, then the best condition in which it can be for putting the seed in, is after a slight shower has moistened the soil. The plan of moistening or damping barley seed in very dry weather has been suggested as a good means of securing a braird. In one of the earliest papers of the oldest of our Agricultural Societies—namely, the Bath and West of England—we met with the following notes on this subject:—

"The last spring (1784) being remarkably dry, I soaked my seed barley in the black water taken from a reservoir which receives the draining of my dung-heap and stables. As the light corn floated on the top, I skimmed it off, and let the rest stand twenty-four hours. On taking it from the water, I mixed the grain with a sufficient quantity of wood ashes, to make it spread regularly, and sowed three fields with it. I began sowing the 16th, and finished the 23d of April. The produce was 60 bushels per acre of good clean barley, without any small or green corn or weeds at harvest. I sowed also several other fields with the *same seed dry*, and without any preparation; but the crop, like those of my neighbour's, was very poor, not more than twenty bushels per acre, and much mixed with green corn and weeds when harvested. I also sowed some of the seed dry on one ridge in each of my former fields, but the produce was very poor in comparison of the other parts of the field."

Another "note" is as follows:—

"Take out one-third of the contents of the sacks of seed barley or bere, to allow for the swelling of the grain. Lay the sacks with the grain to steep in *clean water*; let it lie covered with it for at least 24 hours. When the ground is very dry, and no likelihood of rain for ten days, it should lie for

36 hours. Sow the grain wet from steeping without any quicklime, which, though often recommended, can only poison the seed, suck up part of its useful moisture, and burn the hands of the sower. The seed will scatter well, as clean water has no tenacity, only the sower must put in a fourth or third more seed in bulk than usual of dry grain, as the grain is swelled in that proportion. Harrow it in as quickly as possible after it is sown, and, though not necessary, give it the benefit of fresh furrow if convenient. You may expect it up in a fortnight at farthest."

A slightly moist, a soft and friable soil, is necessary for the barley. To secure the two latter features the whole of the details of the preparation of the land must therefore be carried carefully out; and they at the same time indicate the nature of what is called "barley" soil, a thing essentially different from a "wheat" soil, which latter is difficult to bring into the fine friable tilth so necessary for the barley. As regards the soil, then, for the barley crop, Professor Wilson sums up the whole that need be said on the subject thus: "Agriculturally speaking, their range is from the lightest gravels up to the medium loams; beyond a medium loam the proportion of clay renders the soil unfit for the cultivation of barley." The difference in the structure of the roots of the wheat and the barley plants indicates the difference required in the soil, or rather its condition. The roots of the wheat have a remarkable tendency to push themselves deep into the soil as well as to ramify in all directions; those of the barley plants have the power given them of spreading laterally, and a development remarkable for its quickness. We see, then, the wheat plant distinguished by what we may call a verticality of root-development and a slowness of growth, and the barley by a horizontality and a quickness of growth. The roots of the wheat plant draw their assimilable food from the soil slowly, and from a great depth; those of the barley have to draw it quickly, and from the surface, and much more in a given time than the wheat roots. This quick abstraction of the food from the soil by the barley plant is also aided by a peculiarity which distinguishes them—namely, the number of root fibres or "hair-like processes" by which the roots are supplied, and which Professor Lindley calls "the mouths of the root." A quick drawer and a greedy drawer of the manurial matters contained in the soil, and that soil confined by the habits of growth of the plant, the inference is readily drawn, that the crop which precedes the barley crop should be that which leaves the soil in the condition best fitted for these habits, and rich in manurial constituents—these conditions indicate, therefore, a root crop as that which should precede the barley. The processes involved in the preparation of the soil for the root crop are just those which bring about the condition best fitted to aid the growth of barley; and the advantages of the rotation are perhaps rendered still more striking when the turnip crop is partly or wholly fed off by sheep. "The appropriateness of this course for barley rather than for wheat, besides the advantage arising from the season of the year at which the land is generally clear for the corn, rests

mainly on the fact, that the manure by folding, with the subsequent light working of the land, is more confined to the *superficial layers* of soil, in which, comparatively, the roots of the barley play more freely." At the same time, however, it is to be noted, that a "disadvantage of growing barley after the folding of sheep on turnips is, that with high farming the land is apt to be thus left in too high a condition for the crop to succeed well in the average of seasons; whilst on the heavier lands there is frequently much injury done to the texture, rendering it difficult to get the fine tilth so essential to the favourable growth of barley." The various points connected with the question, What is the best rotation for any given crop? while they are most important, and while their right solution would exercise a most favourable influence upon the practice of agriculture, are unfortunately so difficult of decision, and involve so much, that, if not often contradictory, the evidence on them is at least conflicting and confusing; and the whole subject of "rotation" is yet in a most unsatisfactory condition. "Rotations, or systems of cropping," as so suggestively pointed out by Professor Wilson, "must be more or less guess-work, founded, if you please, upon long practice and experience, but good only where exactly the same conditions can be secured." And on this subject we have ourselves elsewhere made the following remarks:—"In view of the wide diversity which characterises the practice of agriculture, and the influence of a widely different variety of soil and climate, it seems to us not unlikely that no theory of rotation applicable to all the circumstances of farming will ever be established. As our soils differ in nature, and climate and locality in influence, and thus necessitate different modes of treatment, may not also the principle necessitating a rotation be different? or may not a rotation be in some cases unnecessary? Do not the cases of Lois Weedon and Colne Engraine culture, and the experiments of Mr Lawes, bear out this view?" Well did Mr Pusey say—and pity it is that these, like other utterances of his, so full of suggestive truth, have not been received by a larger audience willing to be benefited by them—"that while the facts of other sciences were simple, their laws single, those of agriculture were not so:" they varied "with the climate, the soil, the seasons." "What is true," he says, "in Kent is not true in Sutherland." But however much discrepancy there may be between the statements and opinions of farmers as to the best rotation to be adopted in the case of any crop, and however much men may disagree as to the details, still all must, we think, unhesitatingly coincide with Mr Lawes and with Dr Gilbert when they urge the "necessity of considering the various habits and conformation of the different crops of our rotations in relation to their sources of growth;" and agree with them in this also, "that the important bearing of such considerations in modifying the conclusions to which a more purely chemical view of the offices and province in a system of manuring

of the various constituents would lead, is one of the first lessons which the progress of field-experiment teaches." These celebrated agricultural authorities point out very clearly the conditions of growth of the barley, and which we here epitomise. The autumn crop of wheat depends greatly for its success upon the progress during the early months of its growth on its underground development. Other things being equal, this development of root is greatly favoured by a liberal supply of nitrogen within the soil; and that this being supplied, the range of feeding ground, so to term it, of the fibrous roots, was so extended, that the mineral constituents of a much larger area of soil than would have been otherwise the case were rendered available, when needed, in the after-stages of the plants. The case is, however, very different with the barley crop; here winter-growth and a compressed soil, which tend to increased depth and area of root-distribution, are not present or desiderated; on the contrary, we have spring-growth, the staple of soil shallow, light, and open. Under these circumstances, and a limited period of growth, we find the "direct supply of some of the rarer but essential mineral constituents of our soils much more efficient with the barley crop than with wheat." With the multiplication and thickly distributed network of roots which we have shown to be the characteristic feature of the underground development of the barley, "the greater must be the resources of the plant within its comparatively limited period and area of growth." Thus it is that the increased supply of certain important constituents within a limited area, enables the plant to provide itself more freely and rapidly with others it may require.

Messrs Lawes and Gilbert, as the result of an elaborate series of experiments upon the growth of barley, have shown that "the produce of barley obtained in *rotation* (the usual four-course or Norfolk system—turnips, barley, clover, wheat), even when the turnips were both unmanured and carted off, was considerably greater than when the crop was grown annually in succession on the same land," so that, as they remark, it may fairly be concluded that a "characteristic effect of alternating the other crops with the barley" is to leave more available nitrogen from some source within reach of its roots than is the case when the barley is grown in successive crops on the same land, or when a number of turnip crops were likewise taken in succession off the land previously; and the conclusion they arrive at is, that, like wheat, barley requires "a nitrogenous condition of soil," and that full crops cannot be obtained unless there be *within* the soil available supplies of nitrogen. The bearing of those remarks upon the question of rotation is important, and will at once be recognised by the intelligent reader.

The following on the manuring of barley, by the authorities named above, will be a useful supplement to what has been already given on this point:—

"Of direct portable manures for barley, Peruvian guano, or salts of ammonia, or nitrate of soda—either of them, with a small quantity of superphosphate of lime—are the best. Rape-cake is also a good manure for barley, but it is generally too high in relative price. These manures, as well as purely mineral manures, are most advantageously applied before or at the time of sowing, so as to be somewhat distributed through the surface-soil by the mechanical operations. As a mere top-dressing, nitrate of soda is the best. Of the more exclusively nitrogenous manures, salts of ammonia and nitrate of soda, the nitrate acts somewhat more rapidly for a given amount of nitrogen supplied. The action of the purely nitrogenous manures is economised by admixture with a small quantity of superphosphate of lime, or other appropriate mineral manure. Other things being equal, the later the barley is sown the less should be the proportion of nitrogen in the manure, and greater that of the mineral constituents, otherwise the crop is liable to be too luxuriant; and with a limited range of root in the soil, it will probably not find mineral constituents rapidly enough in the later stages of its growth for a favourable development and maturing of the seed."

Let us, then, now draw our attention to a review of the modes in use for the cultivation of barley. We have already referred to the *preparation of the land*. In a practical paper on the "Management of Barley" by Mr H. W. Keary, a prize essay published in the 'Journal of the Royal Agricultural Society,' there are some very excellent remarks on this point. And here the importance of attending to this may at once be recognised, from the fact, so carefully pointed out by Mr Keary, that upon it depends most materially the *quality* even perhaps more than the quantity of the crop. So that although, as a rule, what are called "barley soils" produce the finest yield both in quality and quantity, still remarkable differences in these respects are noticeable, and this arising from the different modes in which the same kinds of barley are cultivated. Mr Keary gives some most excellent remarks upon the modes practised in various districts. In several of the midland counties there are fine deep loams upon gravel, and also upon clay, which produce a "very bold heavy barley," but which, however, does not take the first place in the London markets for malting purposes. On such districts, and with this soil—termed turnip and barley soil—the barley is usually taken after the turnips, the turnip crop being previously fed off either wholly or partially by sheep. It is on such soils that the truth of the adage, "Sheep have *golden feet*," is so well exemplified. The land, firmly consolidated by the treading of the sheep, and well manured by them, is broken up by the plough in the autumn or winter months, and allowed to remain exposed to the ameliorating influences of the atmosphere till seed-time. The land—and this by the practitioners of some districts is worthy of notice—is not again ploughed in spring, but simply scarified, or grubbed and well harrowed. The seed is then deposited generally by the drill, but sometimes it is broadcasted. A good deal has been said upon the comparative advantages of these two modes of sowing, but while there are benefits to be derived from

the dispersing of the seed over the ground—for the more this is done the better—still the fact that the depth is unequal operates most prejudicially against the broadcasting system; for the growth is most unequal, some of the grains having a start long before others, so that the quality of the sample at harvesting is most unequal also, and the trouble involved in cutting very considerable. Now, by using the drill we can secure uniformity in the depth at which we deposit the seed, and, what is of immense importance in a crop where uniformity in the quality of the sample is so important, we can also secure uniformity of growth and of ripening. In the midland districts which we are now considering, the sowing season varies, according to circumstances, from the middle of March to the end of April, the seeds sown belonging to the varieties known as Chevalier, Nottingham, Long Ear, and the old Common barley. Of these the Chevalier is gradually growing in repute, more being grown now than formerly, even although the quantity per acre is not so satisfactory as other varieties; but it is highly esteemed for malting purposes, and therefore commands the highest price. Barley in these districts is sometimes sown after fallow, this being where the soil is rather a “strong clay.” In autumn the land is left in a rough and cloddy state from the plough; and the seed is sown upon this as early after February as possible, and then dragged or scuffed in without further preparation. Simple as this plan appears, Mr Keary states the crops produced by it to be very good, and inclines to the belief that possibly for such soils it is the best that can be adopted. In some districts of the southern counties the turnip-land is ploughed up as soon as it is dry, well worked twice with the drag-harrow or with the scarifier, and then the seed is drilled at the rate of three bushels to the acre. The common sort of barley is generally used, the Chevalier not being there a favourite in consequence of the low quantity of its yield. In Herefordshire, which is celebrated for the fineness of its barley crops, the best crops are grown upon the light soils which have a chalk subsoil. Generally these lands are ploughed only once, the seed being sown in March or April. On the stronger lands of this country, fine malting samples could not be obtained from the old Common barley sown; now, however, this difficulty is obviated by the use of the Chevalier variety.

Although the barley crop is one which delights in a genial warmth of soil and of climate, nevertheless we find its extension very marked in what one would suppose to be the apparently (for barley) ungenial districts of the Yorkshire and Lincolnshire wolds, with their somewhat northern districts; but good farming has overcome the difficulties arising from this circumstance, and the barley grown in these districts equals, if it does not excel, that of other and more favoured places. The white turnip is generally grown in these northern districts, the crop being fed off either partially or wholly by sheep; if swedes are grown, they are not taken up and stored,

but left in the ground till wanted in spring. The reason why white turnips are grown in place of the elsewhere more esteemed swedes, is, that the farmers of the wolds believe that a better crop of barley is obtained after them than after the swedes. Now this opinion is directly opposed to the experience of the Norfolk farmers, so celebrated for the fineness of their barley crops. As the point is one of a decidedly practical and important character, it will be worth while to devote a little space to the consideration of its details. The swede crop is almost universally allowed to be richer in nutritive qualities than the white or common turnip, and it may therefore with safety be predicted that the land will be more fertilised from the application of the manure of sheep fed upon swedes than when they are fed upon white turnips. Further, the longer a crop is allowed to remain upon the ground the more does it exhaust the land. Now in Norfolk the swedes, when grown, are taken up and stored; while in the wolds of Lincolnshire or of Yorkshire the white turnips are allowed to remain in the ground till wanted in spring. Now, asks Mr Keary, may not this circumstance be the reason why such a difference of opinion exists amongst the farmers of two districts alike celebrated for their good farming? and on the point between them Mr Keary has no hesitation in giving in his adherence to the opinion in favour of the swedes as the best crop to precede the barley; and he believes that, by the extension of growth of this valuable root, not only would more sheep be maintained, but that by the increased fertility which would by its means be given to the land by the manure obtained from the sheep fed upon it, it would benefit the clover crop, which follows the barley, and ultimately the wheat, which follows the clover. In the wold districts of Lincolnshire and Yorkshire the land is broken up by the plough after the turnips are fed off by the sheep; it is then, on the approach of seed-time, dragged and harrowed; and the seed is generally sown broadcast, at the rate of 10 to 12 pecks per acre—the seed-time varying from the first week in March to the last week in April.

We shall now briefly glance at the practice of the celebrated barley-growing districts of Norfolk. As already stated, the swede is the favourite crop for sheep-feeding purposes in this county, and is that crop which precedes the barley. But in addition to the use of this nutritious root by the "go-ahead" farmers of the county of the celebrated "Coke," large quantities of oil-cake, crushed barley, and pease, are given to the sheep. To this system of feeding, by which such a valuable manure is obtained, may be attributed the rapid fertilisation of some of the worst lands of the county; and Mr Keary believes it to be by far the best and cheapest mode of bringing a poor farm into a high state of cultivation, for the cake, &c., "passing through the animal, an increase of matter is added to the increase of corn, and the cost of artificial manure is thus doubly paid for." But while the barley crop is by this system undoubtedly

raised in quantity, it is thought that by it the quality is deteriorated; although the pecuniary result may not be affected, the decrease in the quality being more than balanced by the increase in the quantity. In the districts which we have already described, the practice is, as we have shown, to plough the land early and well in the autumn. Now, in the Norfolk district, it is a very general practice to plough twice, experience having, it seems, invariably shown that more barley is produced when the land is ploughed twice than when it is ploughed only once. In ploughing once the manure of the sheep is not so intimately mixed with the soil, the greater portion remaining at the bottom of the furrow; while by ploughing twice the manure is equally and intimately mixed with the soil. The last ploughing is done immediately before sowing, so that a kinder, lighter, and more genial seed-bed is found to be the result than when the sowing takes place on the "dead surface of the land ploughed up many weeks previously." But it is worth while to note that, although the experience of the Norfolk farmers is such as we have now described it to be, it has nevertheless been found that in all soils, except those of the very lightest and the most sandy character, the use of the plough for originally—or for the first—breaking-up of the land for the barley crop, is not so beneficial as the use of the grubber or the scarifier; the furrows turned over by the plough being generally of such a close and impervious character as to be little influenced by the beneficial effect of the frost and atmospheric influences during the winter months. In some cases, therefore, a strong scarifier, with the teeth closely set, is dragged over the land in autumn by four horses, and it is left in the consequent rough and uneven condition all the winter. The plough is then used to prepare the land for sowing in the spring, this being done immediately before the seed-time, the seed being then put in. Another plan is sometimes followed; in this the iron mould-board of the plough is removed, and a piece of rough wood substituted, the object of this being to prevent the furrow being turned completely over, leaving it in an unfinished or roughly broken condition. By the implement thus prepared the land is broken up in autumn, and left rough till spring. As soon as the season is sufficiently far advanced, and the land dry, it is well harrowed; and immediately before the seed is thought right to be put in, the second ploughing is performed, and the seed put in. In the large light-land fields of the western districts of Norfolk it is usual to plough the whole field, and drill across the ridges or furrows. This plan of drilling across the furrows produces a more uniformly deep seed-bed; for it is obvious that where the converse of this holds, and the drill follows the furrows of the plough, the seed will not be deposited equally deep, the surface being uneven, and the drill-coulters running into the furrows will render the work done uneven. After the drilling is performed, the land is well harrowed, and sometimes the roller is used in place

of the harrow; the grass-seed machine then follows, after that the light harrow, and the sowing process is then completed. Where the soil is stronger, the drill follows the plough, and this especially in wet weather, the object aimed at being the thorough completion of each day's work before night sets in. In these soils the barley is allowed to stand through the ground, and be pretty strong in the blade before the roller is applied. This is light, and its office is to break up the clods, and give a little fresh soil and firmness to the roots of the growing plants. On light tender lands the seed is sown broadcast, and turned in with a light one-horse plough; this practice was common formerly throughout the county. In the strong soils of the county which are apt to work unkindly in the spring, the following plan of preparing the land by the two-furrow or ridging system is adopted. A rather shallow furrow is taken at first, and the return is made with a deeper one, leaving a small "balk," and turning it over so as to make a complete ridge. The ridges thus formed are allowed to remain exposed to the atmosphere for some weeks, and as soon as the weather allows in early spring the plough is used to reverse these ridges, and open up and expose their interior to the atmosphere. These ridges are in their turn allowed to remain for some weeks till seed-time approaches, and then a skeleton-plough is used to split them up; the land is then well harrowed, and levelled as much as possible. The drill then follows, and the operation is completed. If all these operations are effected properly in dry weather—for which see an after note—a most admirable seed-bed is secured. The plan, however, is open to objections, of which the following are stated. It is difficult to get the land completely level, and hence, particularly in a dry season, the crop comes up unequal in growth, being much stronger in the alternate rows, the furrows thus showing themselves in the growing crop. This irregularity of growth is of course more observable in the early stages than in the later, but it is obvious that its tendency is to maintain itself throughout the season of growth, so that an irregularity of ripening of the crop and in the quality of the sample must be the consequence.

In the Norfolk district, which we are now considering, the sowing season extends from the middle of March to the end of April, but the first half of April is considered in average seasons the most favourable time. Where land works well, early sowing of barley is good; and in Norfolk, in the strong soils, it is sown early in March. "Chevalier" barley is rapidly becoming a favourite. "Brewers' Delight" grows stiff in the straw, yields a good sample, equal for malting purposes to "Chevalier," and is therefore fast coming into repute. The old "Common Barley" is now but little used. "Long-eared Nottingham" is used by some, "American" by others, and by others again a variety obtained from Leghorn.

In concluding our Notes upon the preparation of the land for the

barley crop, we must draw special attention to the remarks of Mr Keary on the importance of attending to the weather in which, as well as to the details of the mode by which, the work is performed. A great point undoubtedly is to obtain a slightly damp seed-bed; but while this is worth aiming at, it is impossible to find language strong enough to condemn the absurd practice of working the land when it is thoroughly wet—"when the water stands in puddles on the surface." This, however, is not done in order to get the kind of seed-bed we have alluded to above, but specially to accelerate the spring work. The ploughing is then done, it is true, but it is not sufficiently considered that numerous harrowings, rollings, and perhaps clod-crushings, must be gone through before barley can be sown amongst clods, which are the sure result of working in wet weather. Soil forced thus into tillage rarely yields the kind and genial seed-bed required for barley. Some seasons are, however, so continuously wet that it is difficult, if not altogether impossible, to get the land in proper condition for working. Mr Keary mentions a plan for working barley soil in wet weather which he describes as being specially successful. A piece of cord was tied round the mouldboard of the plough, this preventing the smooth shiny surface given to the furrows by the plough in its ordinary condition, and entirely removing the necessity to use the roller. The mode already described of breaking up the land in autumn by a grubber or scarifier, and ploughing the land immediately before sowing, appears to Mr Keary and other authorities to be preferable from every point of view to that where only one ploughing is done, and then putting in the seed.

In a paper by the Editor in the 'Journal of the Royal Agricultural Society,' on "The Growth of Barley after a Grass Layer," there are some points of practical interest noted, of which we shall do well to present a *resumé* to the reader. The paper purports to be a statement of the result "of an attempt to substitute the growth of barley for wheat on light sandy soils, in four following seasons of very varied character." The benefits to be derived from such a substitution, where the barley crop is made to bring in as much money as the wheat, are, the better distribution of the horse-labour of the farm, the retention of a valuable autumn run for his ewe flock, and the fact, which Mr Frere believes in, that less demand is made on the soil by barley than by wheat. As to the advantage of being able at leisure on a light soil in a bleak climate to manure and cultivate one-fifth or one-sixth of the ordinary wheat-shifts, every arable-land farmer will be convinced; while, says Mr Frere, as a "flock-master" he will scarcely know what "value to put on a healthy run, which assists him in keeping his ewes out of the turnips, or enables him to bring them by degrees to their new diet, with a dry run and a bite of grass in the morning, and a fold, probably of rape, in the afternoon." As to Mr Frere's opinion that the barley

takes less out of the land than the wheat crop, seeing that it runs counter to the one frequently held, it will be well to note what is said in support of it. The land selected for trial by Mr Frere was the very weakest portion of his heath land, "black sand on chalk rubble." On this, which is too light to carry any other "lay" than ryegrass, with an admixture of trefoil and Dutch clover for sheep food, "the worst part of the field has been left, at wheat-sowing time, manured and ploughed at leisure during winter, and sown with barley on the whole furrow in the spring, part of it having been folded, the rest having received straw manure,—a ton or two less per acre than would have been applied to wheat." Now those who rely upon the respective analyses of the ashes of the wheat and of the barley crop will, from their similarity, believe that they are equally exhausting crops. But Mr Frere, in advancing the contrary opinion, points out that our best chemists believe that the cereals are parting with nitrogen to a considerable amount, and that during the "whole course of their growth." As a result of this, the waste of this valuable manurial agent will depend upon the duration of the growth of the plant; so that more nitrogen will be parted with by the winter wheat, the growth of which extends over so much longer a period than the barley sown in spring. Of course, the much-disputed question arises, Granting that this parting of nitrogen by the cereals is correct, does it follow that the soil is consequently weakened? Those who believe in the large amount of ammonia derived from the air will of course hold as favourable to their views this same "nitrogenous exhalation" of the cereals, rather than the reverse. But to these Mr Frere puts the following—"Until we have better evidence that the nitrogen, as united with oxygen in the air, becomes largely available for plants, how can they account for the supply of ammonia and nitric acid on which they rely?" But apart from all "scientific speculations," Mr Frere believes that "our growth of barley" may safely be increased on suitable soils, "and this in view of the facts, that while the prospects of wheat are precarious, those of the barley crop are steady; and that by improved skill in brewing, and by the facilities now offered for transporting beer to great distances, the competition offered by the increase in consumption of foreign wines is counterbalanced."

The following shows the combined results of the crops of the four following years:—

Years.	Value per Acre of Barley (on whole furrow).	Value per Acre of Wheat
1859,	£8 9 0	£7 0 0
1860,	8 4 0	9 10 0
1861 (nearly),	11 0 0	9 0 0
1862 (over),	10 0 0	10 12 0
	<hr/>	<hr/>
	£37 13 0	£36 2 0
Average,	£9 8 0	£9 0 6

The wheat average is, however, shown by Mr Frere to be lower than the above—namely, £8, 12s.; and this is obtained by basing the price on the general range of prices of the year (1862), namely, £9—in place of upon the small portion of the crop sold at harvest-time.

We now come to the consideration of the points connected with the *quantity of the seed to be sown, and the modes in use for sowing it*. As in connection with the wheat, so with the barley crop, great difference of opinion exists as to the quantity of seed per acre to be used; some advocating thick, some thin sowing, while as to the modes of sowing it, the same diversity of opinion also exists; so that some advocate the broadcast, some the drill, and some the dibbling systems. Much of what we have said on all these points having special reference to the wheat crop (see former papers) applies equally well to the barley crop. Although broadcasting may be said to be the rule, still an immense advantage arising from the adoption of the “drilling system” is the facilities afforded by it to clean the crop during the early stages of its growth. We are aware that this hoeing and cleaning is not by any means general; yet if the reader will draw to recollection what has been given in a former part of the present paper as to the habits and characteristics of the barley plant, he will at once perceive that the growing crop will be immensely benefited by being cleared from weeds, and the soil consequently well stirred, so as to admit abundance of light and air, and allow the atmospheric influences thus to operate in their usual beneficial way. As to “dibbling,” from what we have heard, and from the result of numerous experiments of our own, we are inclined to think it is even more specially valuable for the barley than it is for the wheat crop—so much so, that if the difficulties attendant upon carrying it out on the large scale are considered such as to be prohibitive of the system, we would at all events most unhesitatingly recommend its adoption in all cases where a special supply of *seed* is to be raised from some favourite variety, or where experiments are being carried out. The whole question of thick and thin sowing is invested with so many points of immensely practical importance that we shall be pardoned if, in addition to what we have already said upon it in a previous paper, we here draw attention to some very suggestive remarks on it by M. Bodin, of the Agricultural School at Rennes, who is a strong advocate of thin-sowing. Referring to the well-known dicta, “On rich land sow thin; you will always have sufficient seed;” and, “On poor soil cover the field with seed; you cannot put in too much,” M. Bodin says that it will be worth while to inquire from whence the notions involved in these sayings have sprung, and how it is that it has come to be believed that putting a large number of plants into land which does not contain nutritive principles, and few into soil which contains much nutriment, opposed as seems written on their face to common sense, should be right. Under the impression that sowing thickly would choke the weeds, M. Bodin

has adopted it in the case of certain crops, but the results obtained taught him, he says, a lesson. By sowing thickly on poor soil, each grain produces only one stem, and that stem only one ear; by still farther increasing the quantity of seed, the produce is still poorer. By the invariable law of plant growth, all the plants will give some grain; but the question arises, Will the stems form themselves, if, by thick sowing to excess, they grow up thicker and poorer? Doubtless, the more the stems are numerous, the poorer in formation will they be, for we put fifty in a space adapted only, perhaps, to grow ten, and yet we expect a good result from such a mode; certainly an expectation as likely to be realised, as he who, putting three times more stock upon poor pasture than he would upon good pasture, fancies he will obtain a better result. The more we encroach upon the available resources of the soil, by putting the plants living upon it to an extreme in number, the more do we reduce the quantity of the produce: if we sow fifty where we should only have ten, it is obvious enough that the food fit for the full development of ten only must be divided among fifty, to the manifest disadvantage of every individual one of the fifty. But not only is the supply of food to each plant lessened in proportion to the excess of plants partaking of it, or withdrawing it from the soil, but another and a very serious disadvantage arises—namely, the roots get crowded and entangled together, and the “tillering,” which is so essential to the healthy development of each plant, cannot be secured. It is difficult to say what is the minimum of earth or root space required by each plant, but, judging from the extraordinary extent to which this development takes place where the plant is allowed a large space of soil to grow in, we have no hesitation in saying that, as a rule, no plant receives, in practice, its proper allowance of feeding and growing ground. We remember very well the result of one out of many experiments we instituted on the modes of sowing thickly and thinly, having reference to the extent of underground (root) development and upper growth (stems and ears), how struck we were by the extraordinary mass of rootlets, and the fine display of stems and ears of a cereal plant dibbled (one of many sown at 12-inch intervals), and another of the same variety sown broadcast in the usual fashion. The broadcast-planted bore a few long lanky stems and small ears; the dibbled, which, in comparison, might be called a forest of stems like pillars, round, long, and strong, bearing full and large ears; the first with a small knot of rootlets, the dibbled plant with a huge bunch. The two displayed a fine illustration of “the thin and ill-favoured,” and the “full, well-favoured” ears of the corn seen in Pharaoh’s dream. But to return to M. Bodin’s remarks on this most interesting subject. While approving of thin sowing, he does not pretend to state the exact quantities which it is necessary to sow to produce a good crop; nor does he approve of “calculations taking for their base the quantity of

grains sown ;” on the contrary, the yield per acre seems to him the most certain. For “in fact,” he remarks, “if I sow some grains singly upon a large surface, the plants will develop themselves in an extraordinary manner, and I shall have an enormous produce compared to the quantity of grain sown, but very little compared with the extent of ground. By this means we shall gather thirty or forty to one, being, however, a small return per hectare. It must, therefore, be left for the cultivator to judge the quantity of seed required, taking care not to diminish it beyond what is necessary for the stems to fill the soil.”

In examining the practice of farming in many districts, one is frequently struck with this, that many modes are adopted which seem to have for their aim to overcome an evil which owes its existence to a bad system, so that if the system was remodelled, preventing the recurrence of the evil, the detail in the mode would not be necessitated, seeing that it was alone adopted to overcome the evil. Many examples of this will recur to our readers, and one may be met with in the argument used in favour of thick sowing for some of our cereal crops (as, for instance, that of the barley, which, as is well known to many of our readers, should, according to almost general belief, “lie thick upon the ground”)—namely, that it keeps down the weeds, which develop most rapidly when the seed is sown thin or in rows. But, as M. Bodin well remarks, “it would be better to destroy the weeds by second hoeing or cleaning, than to run the risk of spoiling your crop, which there is great danger of, if it is left to fight its way amongst the weeds.” Weeds and crops must be always antagonistic; good farming has for its only aim the growth of the crops, and its most untiring and energetic efforts all conspire to prevent the growth of the weeds. M. Bodin concludes his paper by giving a saying, which, although somewhat exaggerated in tone, carries with it, nevertheless, a vast deal of truth—“The worst weed for the corn is corn.” On this point of thick and thin sowing, Mr Keary, the author of the Prize Essay on Barley, of which we have given a *résumé*, states that he is inclined to adopt a middle course between the extremes of thick and of thin sowing. “From eight to ten pecks per acre in kind and genial soils will generally suffice; but on unkind land, in imperfect tilth, it may occasionally be necessary to sow a larger quantity.”

B.

THE FARMERS' NOTE-BOOK.—No. LXXXI.

M. Jules Lecreux on the Potato Disease.—It may seem little opportune to write about the potato disease at a time when this valuable esculent appears to be restored to its former vigour. Such, M. Lecreux admits, may naturally be the opinion of his colleagues of the Society of Acclimatisation whom he addressed at their meeting in Paris in March 1863. But he reminds them that prudence requires that we shall consider the potato as only convalescent, so that a relapse is often worse than the previous malady.

As he has watched over the cultivation of the potato for seventeen years, and has made some remarkable experiments, we think some of our agricultural readers will thank us for translating and abridging his remarks as given in the bulletin of the Society.

"The potato disease first showed itself in 1830 in several districts of Germany, and spread thence into the Palatinate, in Saxony, into Mecklenburg, Bohemia, and Silesia. In these different countries its ravages were such that in several places the crop was reduced to two-thirds.

"Commissioned by the Bavarian Government to find out the cause and the remedy, M. de Martius attributes the evil to a microscopic fungus, which he terms *Perisporium solani*, which might be abundantly produced in the heart of the cellular substance, and be propagated by infection.

"The second appearance of this terrible plague, which was productive of results still more disastrous, was in the end of July and the beginning of August 1845, in certain districts of Belgium and Holland; with desolating rapidity it then spread over a large part of Germany and France; over Great Britain, where such was its intensity that of this precious vegetable there were left only the infected remains. In Ireland, where it may be said to be the sole nourishment of the people, each of whom daily consumes at least ten pounds of potatoes, the crop was completely lost. Suddenly deprived of daily bread, the wretched population was decimated by the tortures and the results of famine.

"This blow spread consternation everywhere, and every one deemed it a duty to inquire as to its origin and the means of prevention. Several opinions were advanced. That of several *savants* was in opposition to that of M. de Martius. Another, very generally diffused, is, that the brownish matter, resulting from the potato disease, is merely an alteration of azotised matters, albuminous or others, contained in the cellular tissue, the alteration being caused by abnormal meteorological influences.

"I willingly uphold this opinion, because, in addition to my former observations on the influence of stormy weather, I have this year

observed, in the departments of the Nord and of the Pas-de-Calais, where the leaves and the flowers were abundant, that a violent storm, bursting out on 7th July, almost instantaneously reduced the most vigorous verdure to the state of brown leaves exhaling a fetid smell.

"The disease, according to M. Morren, begins with the leaves, even the flowers and the fruits receiving the infection, not by the *Perisporium* but by *Botrytis infestans*.

"Then comes M. de Montague, who admits the action of *Botrytis infestans* on the herbaceous parts, but declares that he had never met this cryptogam on the tubers.

"Several philosophers have attributed the evil to parasitic insects, whilst MM. Gruby and Guérin have presented to the Academy of Sciences a report, in which M. Guérin will by no means admit the action of insects as the cause of the disease.

"I have often, after the alteration of the cellular tissues, met with insects and vegetable parasites, but not constantly, which induces me to regard them not as the cause but the result of decomposition. While gaining instruction from all the works from which I have derived most of the preceding observations, I have since 1845 paid increasing and minute attention to the agricultural part of the question.

"At first I called to my aid various known manures, guanos, *colombine*, or the guano of pigeon-houses, different composts, dung from byres and stables. These last I greatly prefer, having observed that the employment of too hot and active manures produced an excess of tender and lengthy leaves, to the injury of the flower, and then of the strength and quality of the tubers.

"I also had recourse to stripping off the leaves, followed by liming, and to pulling up the stems, and was not more fortunate than my colleagues who tried similar experiments.

"I wished to satisfy myself whether the astonishing effects of fecundation and hybridisation, which have so many impenetrable secrets, might not have an advantageous influence on the tubers.

"With this design I procured potatoes from as many localities as possible. I endeavoured, if I may use such an expression, to unite different kinds, by planting them near each other, two or three of one kind, then two or three of another, as many of a third, and so on, in such a way that the flowers of all the kinds might communicate their pollen. I was equally careful to change the ground frequently; and thus, at the end of a few years, I had potatoes which did not spoil, while those cultivated in the ordinary way submitted to the general influence. Whilst the crop of the country was almost destroyed, hardly any diseased tubers appeared in my experimental plantations.

"After some years' cultivation, I gave potatoes to my neighbours, who then obtained satisfactory crops.

“What was the cause of these results? Chance? No; this word cannot be admitted into our society, where valuable elucidations such as I solicit may be given.

“As to myself, I state facts. Among the assigned causes of the disease, M. Morren alleges that it begins with the leaves, even with the flowers and the fruits. I am the more disposed to believe this, because strongly persuaded that fecundation acts on the tubers, consolidates them, and gives them strength to resist the disease when the leaves are attacked by it, and then, like races regenerated by crossing, they perpetuate themselves for a long time in good condition.

“The exceptionably good crop of the year 1862 was, in my opinion, the result of fecundation due to an abundant production of vigorous flowers, whose rich influence had already produced its beneficial effects when the leaves were instantaneously blasted.

“Moreover, if the germ of the disease can be communicated by the flower and the fruit to the stems, and then to the tubers, why may not the healthy germ be communicated in the same way?”

This theory of M. Lecreux is at least as feasible as many other so-called discoveries of the cause of the potato disease. And as his observations extend over seventeen years, and are stated with perfect confidence in the beneficial result, they deserve to be tested by his experiment being repeated in various localities. If a sound crop of potatoes may be insured by the simple expedient of planting different kinds in alternate rows, we should indeed be grateful to the ingenious Frenchman for indicating a mode of culture requiring no increase either of labour or of cost.

In illustration of the uncertainty still prevailing in regard to the origin of the potato disease, we need hardly state that in this country very many refuse to acknowledge that it is due to abnormal meteorological influences. Mr Berkely, a great authority on *Fungi*, asserts that almost every good author now ascribes the potato murrain to the attacks of a parasitic fungus—*Peronospora infestans*.

AGRICULTURAL SUMMARY FOR THE QUARTER.

IN the corresponding quarter of last year we had the gratifying announcement to make that the harvest was among the earliest and the best that we had had for many seasons. This year cutting was commenced about the usual average time. The crop is not nearly so heavy as it was in 1863; the straw is short, particularly of oats, and stackyards have not the extensive appearance they had after last harvest. It is expected, however, that the yield on the barn-floor will be larger than the size and number of the stacks would lead one to believe. It is, of course, too early yet to speak with any authority on this matter, very little grain having as yet been thrashed out; but in all cases that we have heard of the new crop coming under the operation of the mill, farmers have been gratified to find that it took more sacks to hold the grain than they had expected. The shortness of the straw is accounted for by the lack of rain during the latter part of June and July; and until well into August, no moisture of any consequence fell. During this time, also, the weather was cold and ungenial, and there was scarcely any growth whatever. The pastures were completely browned—the turnips, potatoes, and other root crops languished—and the cereals made no progress. About the middle of August a most beneficial change took place: rain fell—a nice warm, grateful rain, accompanied with pleasant sunshine; and under their combined influence all field-fruits shot forward with amazing vigour. The golden hue rapidly spread over the corn—the turnips which were drooping and withered raised their heads and assumed a livelier green—and potatoes, the colour of whose stalks seemed to proclaim that their period of growth was over, were stimulated to renewed life. Even the pasture-fields, though the showers came too late to be of such material service to them as they would have been at an earlier period of the season, did their best to respond to the touching appeal of rain and sun; and if they could not become luxuriant, they at least threw off their parched and russet garb. The early part of the harvest was one of the most beautiful that heart could desire: clear days were succeeded by fine nights, and the farmer was saved all care and anxiety about whether those employed under him were cutting the grain in proper condition. So propitious was the weather, that it was impossible for even the most stupid to go wrong. They had nothing to do but reap even on, and cart into the stackyard as soon as the stooks had been a certain number of days in the field. The barley secured during this time was of splendid colour—as beautiful, perhaps, as any we have seen for many years in Scotland. In East Lothian the farmers were anxiously wishing for rain towards the end of August. By this time a good many had got their cereal harvest so far advanced that they were of opinion that a soaking

wet day or two would do their green crops a great deal more good than their corn harm. The western district of Mid-Lothian, however, did not suffer so much for want of rain; and farmers, as a whole, would have preferred to wait for moisture until all their grain was in the stack. In consequence of the drought, both the cereal and the root crops, more especially the latter, west of Edinburgh, are this year better than on the drier and higher-*rented* lands east. This, of course, is a very exceptional circumstance, our climate generally being too dripping rather than too dry; therefore, in ordinary years, the west cannot compete with the east. The weather for the last ten or twelve days has been very unsettled; and carrying, which, if the days and nights had continued fine, would have been over in the lowland districts by this time, is not yet quite completed. On the whole, however, the harvest may be described as having been a remarkably favourable one. In the high and later districts an immense deal of damage was occasioned by wind-shake in the first and second weeks of September. Such injury, it is supposed, has not resulted from the same cause since the year 1811. Many farmers have suffered to the extent of £200 or £300, and the loss of some is estimated as high as even £500. It is a fact worth noting, that those using reaping-machines came off comparatively unscathed, having been able to get through their work much sooner than those employing manual labour only, which in some parts was scarce and expensive to procure. Not a few agriculturists, who scarcely lost anything, are under the impression that, if they had not employed mechanical means for cutting their grain, their loss from shake would have been very great, as the cereals ripened so fast and so nearly the same time that it would have been otherwise impossible to overtake all the ripe fields before the storm came. In Scotland it may be stated generally that the oat crop will be short, that barley will be a full average, and wheat an average, or nearly so—all, however, being short in the straw, which is unfortunate, now that stock-feeding is so commonly practised, and on the whole so profitable. Beans are a fair—indeed a good crop in some parts of the west; but east we have seen many fields short in the straw, and but thinly podded, owing to the attacks, it is said, of some insect. Turnips will turn out a better crop than it was at one time believed they would, but it is doubtful whether over the whole country they will prove an average. The dry cold weather in the earlier period of their growth retarded them very much, and it is just questionable now whether the bulbs will attain so large a size as usual. There are, however, many excellent fields in the country where neither tops nor roots are lacking. The yield of potatoes last year was something quite enormous. This year it is much smaller, but the greatly enhanced prices will make them fully a more profitable crop for the grower. They are of excellent quality, and as yet there is no appearance of disease. Cattle.

and sheep during the early part of the quarter brought quite unusually high prices, the latter especially; but the long track of dry weather, the bareness of the pastures, and the fears that the root crops would turn out a comparative failure, tended to reduce their value, but they are still high. So long as wool remains at its unwonted rate, sheep are likely to continue dear.

The drought in Scotland is said to be greater than in 1826, many wells that then gave water being this year dried up, and marks in river-bottoms were seen that before were merely traditions of a past generation. And bad as we were in Scotland, they were unfortunately much worse in England. There water had often to be purchased at considerable expense, and to be carried from long distances. The result of this want of moisture is that the root-crop is woefully deficient in England, and that the large grazing counties, such as Norfolk, will not be able to keep above half or two-thirds of the stock they usually feed. The general statement about the crops in England is, that wheat is about an average crop, but lighter in weight; that barley, though varying considerably in different districts, is fully an average, but that some of it will not answer well for malting purposes; that oats are under an average, but of good quality; that beans are much under the average, in some places not half a crop; that pease are good, and got in fine condition; and that turnips will not be half, in some counties not a quarter of a crop. Potatoes are also sadly short. This scarcity of fodder and roots will be sure to enhance the price of artificial feeding substances, and every effort should be made by farmers to economise the natural food as much as possible by the use of the pulper and chaff-cutter.

The French harvest is stated not to have turned out so well as usual, and the reports from America, while as yet the corn was standing, were to the effect that the aggregate yield would not come up to an average. Notwithstanding these rumours, however, the fact of a short crop here has caused foreigners to send, in spite of the low prices, larger quantities of grain than came in last year. Up to the time we write, the Board of Trade returns have only been made up to the end of July, at which date, taking wheat and flour into account, we have received nearly 120,000 quarters more than in the corresponding period of 1863. The excess in the month of July over the like month in last year is very great—upwards of 200,000 quarters in wheat alone; the exact imports being 578,119 quarters to contrast with 374,603 in the corresponding month a year ago. Looking at these figures, we cannot venture to hope for much higher prices for cereals this year.

Agricultural Shows.—The past quarter has been prolific in these gatherings—perhaps more so than is good for the advancement of agriculture. In the corresponding quarter of last year we took occasion to say that it would be better to amalgamate

some of the local societies in one of a central character, in order that larger premiums might be offered for stock, which would, of course, naturally have the tendency to draw out finer animals than we usually see at these district meetings. This idea has been followed out by the agricultural press, in consequence of many of these local associations having fallen much off in quality and interest this year, and it is proposed that a central exhibition should be held in Edinburgh. It is argued that the money and the energy which is now expended in getting up the numerous wretched displays of stock in the three Lothians, would, if combined, result in procuring a first-rate exhibition in the metropolis. There can be no doubt of it. It is the old story of the bundle of twigs. Singly they are comparatively worthless, united they are strong. We trust the proposal for a union will be carried into practical effect, as it was evident this year that many of the local shows had not their average support. The two chief attractions in the show line this season, there being no international display, were the two Royal Societies, the English one being held at Newcastle, and the Scotch one at Stirling. Both were excellent alike in a pecuniary and instructive point of view. At both places more money was taken at the doors than usual, and at both the stock exhibited were in the aggregate superior to those sent to previous shows. In particular may be noticed the magnificent exhibition of shorthorns at both places, a Scotch bull being the champion in the aged class at Newcastle, a position which he had previously earned for himself at the Highland and Agricultural Society's show at Kelso. Never before, we believe, were there such full shows of this particular breed of cattle (which may be described as the aristocracy of the bovine race); and although there may have been seen at rare intervals specimens surpassing in beauty any of those exhibited either at Newcastle or Stirling, we think we are right in saying that the average merit of the whole was greater than on any previous occasion. The sheep at Newcastle, and the horses at Stirling, particularly as regards the latter, were superior to any show previously held. Open judging is now permitted at both places; and at the English show the arrangements are so good, each class of animals being brought into one ring, as to render the manipulation of the jurors very interesting. Except in the case of the horses, the same cannot be said about the Highland Society. The merit of the concession to admit the public while the judges are at work, has been greatly lessened by the means adopted for keeping the public at as great a distance as possible from the "scene of action." In fact, people having paid their money for being present at open judging, find when they get in—like Macbeth with the witches—that the word of promise has been kept to the ear but broken to the hope. Instead of the animals being brought into a ring of moderate dimensions, ropes are attached across each end of the row of stalls in which they stand, the effect of which arrangement is, that the judges are

too far from the spectator for him to form any intelligible idea of their doings. Then there is the trouble and inconvenience of wandering from class to class among the same breeds of animals; whereas, at the Royal English, all animals of one breed are brought into the same ring. The mountain comes to Mahomet, instead of Mahomet being obliged to go to the mountain. There was a good deal of complaint among visitors to the Stirling show upon the points on which we have touched, and we believe it is only necessary to direct the attention of the secretary to the matter in order to have it remedied. In connection with the implement department, an unfortunate disagreement arose as to the publication of the report. It was asserted by the secretary that the committee had acted unwarrantably in causing their report to be published before it had been sanctioned by the directors; and the implement committee retort that they gave in their report in the same manner as they have been in the habit of giving it for years, and that if blame rests anywhere, it is on those in connection with the secretary's office. The chairman of the implement committee has resigned in consequence of the imputation cast upon him, and a like course has been followed by Mr Stirling, the consulting engineer of the Society—a gentleman who has held the post for a great number of years, and one who is very highly respected. It is likely that more about this quarrel will be heard, for it is impossible that the Society can allow two such men to become disconnected with it in this manner without sifting the grounds of their resignation to the bottom. Major Hunter, of Thurston, has also written to the press denying any responsibility in the matter, and throwing the blame upon the secretary's office. Besides the after-dinner speeches at the shows, among the most interesting of which may be mentioned those of the Duke of Argyll at Stirling, and Lord Stanley's at an English meeting, where his Lordship advocated strongly the granting of leases—a practice not common in England, and objected to by many landlords there—we have had some more formal and interesting papers read at agricultural gatherings. The Cattle Diseases Bill, which we noticed at some length in last summary, after being modified by the select committee, was eventually thrown out.

Position and Prospects of English Agriculture.—This was the subject of discussion at the inaugural meeting of the Midland Farmers' Club held at Birmingham, where Mr R. C. Chawner, the president, and a well-known agriculturist, in an address replete with good sense, expressed his opinion that the present condition of agriculture was one of transition, and consequently of uncertainty and doubt; and he attributed this unsatisfactory state of things to the utter want of precaution on the part of the landowners and the legislature when the policy of our system was changed from protection to free-trade. The change from restriction to free importation should have been accompanied by

such measures as would have enabled the farmer to overcome the difficulties of that great change without suffering or loss. He thought it would have been a great mutual advantage to the owner as well as to the occupier of the land if yearly tenancy had given place to long leases. Moreover, the Legislature, in repealing the corn-laws, should have repealed any tax which prevented the necessary increase of capital; leases should have become the rule of tenure, and the malt-tax ought at that time to have been repealed. He argued that the principle upon which agriculturists should found their future proceedings, as the one most suitable to the requirements of the present age, was what was called "the commercial principle." Applying the test of this principle to the measures proposed for future adoption by the cultivators of the soil, they would generally come to a right conclusion, and might hope for a prosperous future, if the hearty co-operation of the landowner with the land-occupier could be obtained. The co-operation of the landowner was essentially necessary in the general application of steam-power to the cultivation of the soil if the ultimate success of English agriculture was to be thoroughly promoted. Proceeding to consider the position and qualifications of the occupiers of the land, upon whom depended, in a great measure, the future history of English agriculture, Mr Chawner dwelt upon the necessity of the farmer being, to a certain extent, an educated man. In his opinion, the direction in which the daily education of the farmer should be pointed was the study of the qualities and constitution of the soil he cultivated, the food-elements of plants, their properties, and the most efficient, and, at the same time, economical means of restoring to the soil those fertilising qualities of which by cropping the land is annually deprived; for the law of compensation and replacement of nutritive substances which the crops had carried away from the soil was the foundation of rational husbandry, involving, of course, the great sewage question, which he hoped would be discussed in that club at some future time. Stock-farming, Mr Chawner was convinced, must henceforth be the foundation and leading feature of English agriculture. The recommendation of laying down arable land to permanent pasture, he considered as the shallow idea of amateurs and speculators. To his own thinking, the general variety of green crops which might be produced upon arable farms far exceeded the capacity of mere grass-land in the rearing and feeding of stock. It was not to be lost sight of, however, that farmers, in multiplying their flocks and herds, multiplied their risks of loss from disease. With the view of meeting this, he urged the adoption of the principle of insurance. He believed a farm-stock insurance society, framed upon an extensive basis, and on the limited liability principle, supported by landowners and other capitalists, must form the foundation—the real starting-point—for the establishment of the new system now proposed as the basis of

English agriculture. Stock-farming was, moreover, in his belief, the true foundation of corn-growing in this country. The views of Mr Chawner seemed to be generally adopted by the practical men present who listened to him.

Preparation of Land for Root-Crops.—An interesting discussion on the subject of the preparation of land for root-crops took place at a meeting of the Boroughbridge Agricultural Society. The question was opened by Mr Outhwaite of Goldsbro', who, in a lengthy paper which he read on the subject, advocated scarifying as much better than first ploughing in the preparation of all descriptions of land intended for turnips. He was of opinion that great injury was sustained from cross-ploughing; and with the view of preventing this, he recommended that the scarifier should be set to work immediately after all the corn was got from the field. The best plan of using the scarifier, in his experience, "is to put it across the drilling at a depth of three inches. I have always found three inches deep enough, providing a scarifier was set to work within five weeks of the grain crop being cut. Every one who is acquainted with scarifying knows how rapidly the couch-grass makes root after the grain is cut." In Mr Outhwaite's opinion, no less than twelve or fourteen inches of loose soil was required to get the couch out after the plough, and only three inches after the scarifier. His endeavour was to get the scarifier once through the land before he began wheat-sowing, and he then invariably left it until the wheat-sowing was completed. "Where there is not much couch," he said, "I seldom or ever use the scarifier more than once. I have a strong wooden drag with wheels attached to regulate the depth. I have the tines shod with steel about three inches broad. I put this implement across the work done by the scarifier. I can do more work with less labour to the horses after the ground has been once thoroughly broken by the scarifier. If I think the couch has not all been loosened, I put the drag through again; but upon land in a very foul state the scarifier must be twice used, and the drag three or four times, to make it thoroughly clean. If I do not get the couch all destroyed in the autumn, whenever an opportunity offers itself, I work it about through the winter with the drag and chain harrows. It may be asked, When do I plough the land? I have no particular time set apart. I first of all take care there is no more couch left alive than I can avoid, and the land is not too wet. I have frequently had land to fallow-plough in April. All the land I get ploughed before the end of January, I have the furrow turned back in the spring. That portion ploughed after January I never plough again that season. I arrange the depth according to the quality of the soil upon all land that will allow it. I have ploughed about nine inches deep. I use the drag once or twice, or as often as I consider necessary." He expressed his aversion to losing any of the moisture accumulated by the land during the winter months. The plough, in

his opinion, was a bad implement to use on the land, and there are not a few more becoming of his opinion, inasmuch as it allowed the nutriment or moisture received by the land during the winter to escape. In his own operations he had accordingly used a new implement, which he described as the digging-plough, and which turned over the land fully three inches deeper. Upon the strongest soils made into turnips he should always use the scarifier as soon as possible in the autumn, and with regard to light soils he thought the scarifier indispensable.

How to treat Grass-Lands.—The subject of how to treat grasslands was prominently brought under the notice of the St Austell's Farmers' Club in a sensible paper read by Mr Oliver of Penhallow. The author, in dealing with this important question, based his remarks upon grass-land generally, and did not confine his observations to permanent pasture. Commencing with seeding, Mr Oliver observed that previous to that operation the land should be carefully freed from weeds; and in order to accomplish this object, as well as to prepare a compact and suitable seed-bed, the surface should be well pulverised. In selecting seed, particular attention should be paid to the kind of grass found to flourish, and such as was readily eaten by stock on adjacent land of similar quality; for it was surprising what effect soil and climate had on vegetation. Grasses which were eaten by cattle with avidity off certain soils, would be rejected when grown on soils of a different character, and hence the necessity of studying nature in the selection of seed. "I have seen," said Mr Oliver, "many fields that have been injudiciously seeded down for permanent pasture with seedsmen's mixtures rendered almost valueless for many years, although heavily manured, by the coarse inferior grasses domineering over the finer sorts, so that it has been found necessary to rip them again at a considerable sacrifice." Great care was recommended in the sowing of grass seeds. "This operation should be done by broadcast machines; and even then, to insure its being rapidly sown—which is a matter of great importance—the land should be twice sown, by taking half the machine's breadth only at a turn. Rich soils, intended for permanent pasture, should be sown about the end of July without a corn crop. Good arable land should be sown about the middle of May with a corn crop, or earlier if with wheat, and the crop be forward. Light plain land, which should be but seldom tilled, is most profitably seeded down about the middle of July, without a corn crop, adding two quarts of rapeseed per acre, which affords much keep in the autumn or following spring." Passing on next to consider the question of the manuring of grassland, Mr Oliver threw out some hints as to the application of dung, which, in cases where coarse old pasture was sought to be improved, he recommended should be well fermented or decomposed, by being previously mixed with rich calcareous or aluminous soil, and applied

in autumn, the grass being first eaten close. Should it, however, be desirable to increase the quantity, recently made and slightly fermented manure should be applied in the spring. His opinion was, that, although lime was a valuable rectifier of rich old grass lands, it was much more valuable when mixed with salt. Peruvian guano and nitrate of soda were both very stimulating manures, but had a tendency to promote the growth of coarse grass. Bone, however, he considered to be generally the best manure for grass-land in Cornwall. Of course it must be understood that localities and previous treatment affect the results of applications; and this, he suggested, should, previous to application early in spring, be partly decomposed. In regard to the stocking or cutting of grass-land, Mr Oliver held that grass intended for permanent pasture should not be cut the first year; that old pasture-land should be occasionally mown, but in all cases early; and that on shallow, quick, arable land, the first year's seeds should be cut. Dealing in the fourth division of his paper with the mechanical condition of grass-land, Mr Oliver considered it prudent to stock dry old pastures heavily with mixed stock during the winter, as he himself had found that the part which got the greatest amount of treading invariably produced the best quality of grass the following summer. He advocated the desirability of draining and trench-ploughing all wet low land previous to its being laid down to permanent pasture.

The Donkey Show in London.—The Mule and Donkey Show, held in August at the Agricultural Show, Islington, under the most distinguished patronage, proved as successful as it was novel, and promises the inauguration of better days for those useful and patient animals, which have for so many centuries been ill-used and despised by mankind. Silver cups and money prizes were offered for both foreign and English mules and donkeys; and in three classes the prizes were confined to donkeys "used by the owners in their business." There were no entries for the prizes in Class I. of foreign mules, but amongst the English mules there was a fine show of animals. The silver cup for foreign donkeys was taken by the Prince of Wales, who exhibited a beautiful Egyptian white ass. Of English stallion donkeys, not used by their owners in business, there was but a small number shown, and in this class the first prize was taken by an animal belonging to Lady V. Cecil. The show was on the whole one of rare excellence, and was remarkable for the beauty of many of the donkeys that were entered for competition. Few who had been accustomed to associate the name of ass with all that was stupid and stubborn and unprepossessing would have imagined, had the Islington Show not taught them to do so, that so much beauty of form, delicacy of skin, variety of colour, and meek docility of disposition, were to be found among a race of animals that have ever been beaten with many stripes, and whose long-suffering, instead of evoking pity, has invariably given

rise to oppression and neglect. Much good may be expected to result from this show, not the least important part of which will, doubtless, be a more intelligent popular appreciation of the many valuable qualities of the ass. Should the show prove the means of alleviating the hard lot of the poor working donkey, and of causing his master to treat him better, it will have performed no mean service to the cause of humanity; and the noblemen and gentlemen who originated it will be held worthy of the greatest honour and commendation.

Effects of the Refuse-water of Paraffine Works on Grass.—The 'Scottish Farmer' notices some experiments with this refuse made by a gentleman well known as one of our pioneers in all agricultural improvement, Mr M'Lagan of Pumpherston. We quote the most important portion of the article:—"One of the latest things utilised in agricultural operations is the refuse-water obtained in the distillation of paraffine oil from shale. The agricultural public are, we believe, indebted to Mr M'Lagan of Pumpherston for the discovery of the fertilising powers of this liquid. At all events, we had never seen or heard of it having such properties until a week or two ago, when we visited Pumpherston Mains. Upon this portion of his property Mr M'Lagan has recently erected works for distilling the oil from the shale which abounds on his estate, and by accident he observed that where a portion of the refuse-water (which would have cost some trouble and expense to get rid of) had been spilt, the grass grew luxuriantly. In order to test the worth of this liquid, Mr M'Lagan watered with it the grass field in which the paraffine works are situated in a series of strips, and the effect of its application is most marvellous. Some strips appeared to look greener and more luxuriant than others, but all bore a marked contrast to the portions of the field which had been left untouched. Mr M'Lagan explained that the whole of the healthy dark-green plots had been produced by one and the same thing—the refuse-water from his works. The reason why one strip seemed stronger and more vigorous than another was, he believed, owing to the different times at and conditions under which it was applied. It is Mr M'Lagan's intention, now that he has clearly established the virtue of this application, to lay down some of his adjoining fields in permanent pasture, and to intersect them with pipes, with mains, so as to be able to discharge the liquid over the fields without the slow, cumbrous, and expensive aid of water-barrels. The stimulating property of this liquid Mr M'Lagan ascertained by analysis to be sulphate of ammonia, which, if our memory serves us right, it holds in solution to the amount of 12 lb. in every 100 gallons. It is greatly to be wished that other proprietors of paraffine works would turn their refuse to a like useful purpose, instead of allowing it to run to waste, to pollute and kill the fish in our streams, or, as in some cases we have heard of, to endanger the health of the people."

Grain and Corn Imported during the last Twenty-three Years.—On the motion of Mr Caird, who is one of the very few in Parliament who have a practical knowledge of agriculture, a return has been printed, showing all the grain and corn imported into Great Britain and Ireland from foreign ports during the last twenty-three years, with its estimated value so long as that has been ascertained. The least quantity of all kinds of corn, flour, meal, &c., imported since 1841 was in 1843, when it was only 1,433,776 qrs. In 1846, the famine year, it bounded up from 4,752,174 qrs. in 1845 to 11,915,587 qrs. The most ever imported was in 1862, when we received no less than 18,441,791 qrs., paying for it £37,772,194. Last year the receipts were 15,352,559 qrs. of all kinds of grain, flour, &c., and the cost £25,955,939. The abundant harvest of last year, therefore, made a difference of nearly twelve million pounds sterling. The average yearly imports for the decennial period ending 1850 was 5,810,470 qrs.; for the decennial term ending 1860 the average was 9,629,425 qrs. The value of the imports was not computed before 1854, in which year it stood at £21,760,282. The lowest payments for breadstuffs since was in the following year, when it was £17,508,700. The highest was the sum given above for 1862.

Supply of Potatoes to London.—The importance of the potato as an agricultural crop may be gathered from the fact that the Great Northern Railway alone has spent £40,000 upon improving the accommodation of their premises for potatoes. "Scarcely," says the 'Railway News,' which supplies the information,

"Had the line been opened when the Yorkshire potato-growers applied to the directors to afford them some facilities for the transport of their produce to the London market. Their request was complied with, and the conveyance of a few hundred tons of potatoes in one season from Selby to London was the beginning of a carrying trade which may now be roughly estimated at 85,000 tons a-year, or (taking one ton as sufficient during twelve months for consumption by a family of ten persons) an amount of potatoes sufficient to supply the wants of 850,000 persons. Such has been the development of the trade in the course of twelve years; and as it is a growing trade, and one sure to be stimulated by an increase in the amount of accommodation afforded to it, it is not hazarding too much to say that before the lapse of another period of twelve years one-half the entire population of London may expect to be supplied with potatoes from the Great Northern Railway. At present this trade is conducted by thirty-five factors, who have hitherto carried on their business in little wooden huts, not unlike sentry-boxes, paying a small toll to the company for the privilege. Badly, however, as they have been housed, they have been far worse situated in regard to the facilities of receiving and forwarding their consignments. They have been altogether without store accommodation—a circumstance which compelled them to get rid of the potatoes the moment they removed them from the company's waggons, which, in itself, has been no easy task, owing to a deficiency of siding accommodation, and the consequent blocks upon the lines. On one occasion, as stated by Mr Packs, there were as many as 900 trucks waiting to be unloaded. This must have been a great inconvenience to the factors, and no less an inconvenience to

the company, whose rolling stock was to that extent crippled so long as the block continued. The recurrence, however, of any such drawbacks is now about to be obviated, for the whole of the old terminus in Maiden Lane has been set aside as the area of the new market. On that site the company is now building a long range of warehouses, thirty-eight in number, fitted with dry and well-ventilated cellars for the storage of the potatoes. In front of each there is fitted upon the arrival-line a turn-table, communicating with a short line of about 60 or 70 feet long, which strikes from the main line at right angles, and runs up to the warehouse door—in other words, the line throws out here thirty-eight short spurs. Each spur is supplied with a wide platform, at which four waggons can with ease deliver their goods, to be at once carried into the warehouse and stored there, either on the floors or in the cellars. It may not be out of place here to mention that in times of frost potatoes are much safer in dark cellars than in places where they are exposed to the light. It will be seen by the above explanation that immediately on the arrival of a potato train it can be broken up into as many portions as there are consignments in it; and that each factor can have the waggons consigned to him turned in upon his own sixty feet of line, and brought alongside his own platform, there to be at once emptied and made again available for the service of the company. This arrangement will be effectual against the recurrence of blocks, add to the capacity of the company's rolling stock, and enable the factor to take advantage of whatever demand may rule the market. The facilities to be afforded to the delivery of the potatoes will not be less convenient than those connected with the reception of them. The warehouses will also have a front towards Maiden Lane, but not upon it, for between them and that thoroughfare the company are constructing, parallel to it, a wide and perfectly level road, on which the drays which are to convey the potatoes from the factor to the dealer can come in, load at the warehouse door, and thence carry off the goods. The company, in order to guard against anything in the way of irregularity, will have their own constables placed at the gate leading into this private road, and their duty will be to see that each dray takes up its proper position, and does not loiter so as to inconvenience others."

Food of Farm-Labourers.—Very elaborate reports have been made by Dr E. Smith to the medical officer of the Privy Council regarding the food of agricultural labourers in the United Kingdom, and these have just been published in the Sixth Report on Public Health. Our readers will remember that there was an article on this subject in the July number of the Journal; and it will be seen, from the extract we give below, that the views stated there are borne out by the official inquiries of Dr Smith, as to Scotch labourers being the best fed:—

COMPARISON OF THE RESULTS OBTAINED IN THE FOUR DIVISIONS OF THE KINGDOM.

"It now remains only to show a comparison of the results of this inquiry in its leading particulars in reference to the four divisions of the kingdom—viz., England, Wales, Scotland, and Ireland—and then to contrast the whole with that of the indoor occupations.

"1. The inquiries have been more extended in the two former than in the two latter, since, in reference to the latter, no attempt was made beyond that of obtaining a hasty glance, and to mark the points of agreement and contrast with the dietary of England.

"2. The number of families visited in England was 370; in Wales, 49; in Scotland, 29; and in Ireland, 52.

"3. The total average amount of carbon and nitrogen obtained per adult weekly was 45,343 grains and 2101 grains; in England, it was 40,673 grains and 1594 grains; in Wales, 48,354 grains and 2031 grains; in Scotland, 48,980 grains and

2348 grains; and in Ireland, with the maize dietary, 43,366 grains, and 2434 grains. When the free hydrogen is calculated and reckoned as carbon, the total daily quantity of carbon is 48,418 grains, whilst that of England was 43,273 grains, of Wales 51,104 grains, of Scotland 52,330 grains, and of Ireland 46,966 grains. Hence in each of these items the total quantity obtained was less in England than in Wales, Scotland, or Ireland.

"4. The cost of this food was on the whole average 2s. 10½d. per adult weekly. It was in England, 2s. 11½d.; in Wales, 3s. 5½d.; in Scotland, 3s. 3½d.; and in Ireland, 1s. 9½d. Hence Ireland far exceeded the other divisions in cheapness of living, whilst in England the value of food consumed was less than in Wales or Scotland.

"5. The economy with which the money was expended was such as to give for each 1s. 16,495 grains of carbon and 791 grains of nitrogen on the average of the whole kingdom. In England, it was 12,398 grains and 495 grains; in Wales, 14,713 grains and 614 grains; in Scotland, 14,868 grains and 716 grains; and in Ireland, 24,000 grains and 1341 grains. Hence Ireland was most conspicuous in the amount of nutriment obtained for the money expended, obtaining nearly twice as much carbon and more than 2½ times as much nitrogen for the money as was procured in England. Then followed Scotland in point of economy, and England was much the lowest.

"6. The amount of breadstuffs obtained per adult weekly was 13.28 lb. In England, it was 12.23 lb.; in Wales, 14 lb.; in Scotland, 12½ lb.; and in Ireland (with the maize dietary), 20½ lb. Hence, Ireland occupies one end of the scale and England the other.

"7. The quantity of separated sugars which was eaten on the total average was 6.6 oz. per adult weekly. In England it was 7.38 oz.; in Wales, 7½ oz.; in Scotland, 5½ oz.; and in Ireland, 4¾ oz. Hence, England and Wales occupied the head, and Ireland the foot of the scale.

"8. The quantity of separated fats on the total average was 5.1 oz. per adult weekly. In England, it was 5.5 oz.; in Wales, 5.8 oz.; in Scotland, 4 oz.; and in Ireland, so little as 1½ oz. Hence Ireland did not obtain so much as ¼ of the quantity of separated fats which was in use among the labourers in England and the other parts of the kingdom.

"9. Meat or bacon was eaten by 92 per cent of all the families included in the inquiry. In England, the percentage was 99; in Wales, 84; in Scotland, 72; and in Ireland, 59. The quantity was in the whole kingdom, 14 oz. per adult weekly. In England, it was 16 oz.; in Wales, 12½ oz.; in Scotland 10½ oz.; and in Ireland, only 4½ oz. Here, again, England obtained the largest and Ireland the smallest quantity, the former being nearly four times the latter.

"10. Fish, in the form of salted but not dried herrings, was much more abundantly used in Scotland than elsewhere; and in no other division of the kingdom did fish in any form occupy a prominent place in the general dietary of the country.

"11. Milk was obtained on the whole average in quantities of 52 fluid ounces per adult weekly. In England, it was only 32 oz.; in Wales, 85 oz.; in Scotland, 124½ oz.; and in Ireland, 135 oz. weekly. Under the head of milk is included new milk, skimmed milk, and butter-milk. Hence, England is not only at the foot of the scale, but almost immeasurably below the position held by the other divisions of the kingdoms. Ireland and Scotland are at the head.

"12. Cheese was eaten on the whole average in quantities of 5 oz. per adult weekly. In England, the amount was 5.4 oz.; in Wales, 9.4 oz.; in Scotland, 2½ oz.; whilst it was not at all obtained in Ireland. Hence, Wales and England occupied the head of the scale.

"13. Tea was drunk by 94 per cent of the whole population, the percentage varying from 100 in Scotland to 99 in England, 90 in Wales, and 57 in Ireland. The quantity per adult weekly was, on the whole country, 0.5 oz.; whilst in England it was 0.51 oz.; in Wales, 0.6 oz.; in Scotland, nearly ¾ oz.; and in Ireland, about ½ oz. Its use was therefore far more general and abundant in Scotland and England than in Ireland.

"14. Thus, on the whole, there was the most nutriment, the least sum spent upon food, the least variety of food, the greatest economy in the selection of food, the most breadstuffs and milk, the least sugar, fats, meats, cheese, and tea, in Ireland. There was the least amount of nutriment, the greatest variety of foods, the most costly selection of foods, the least quantity of breadstuffs and milk, the greatest quantity of sugars, fats, and meats, in England."

AVERAGE PRICE OF THE DIFFERENT KINDS OF GRAIN,

PER IMPERIAL QUARTER, SOLD AT THE FOLLOWING PLACES.

LONDON.								EDINBURGH.							
Date.	Wheat.	Barley.	Oats.	Rye.	Pease.	Beans.		Date.	Wheat.	Barley.	Oats.	Pease.	Beans.		
s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.		s. d.	s. d.	s. d.	s. d.	s. d.	s. d.		
1864.								1864.							
June 4.	41 9	31 0	22 3	28 4	33 5	34 10		June 1.	39 1	29 3	19 4	35 5	36 4		
11.	41 8	30 6	21 2	28 6	34 6	32 8		8.	40 2	29 0	20 3	35 2	36 0		
18.	42 1	30 0	22 2	28 2	35 6	31 10		15.	39 8	29 4	20 6	35 5	36 6		
25.	42 2	29 4	22 6	28 1	39 4	36 9		22.	40 6	28 11	20 10	35 7	36 6		
July 2.	43 8	29 10	22 11	28 6	39 7	36 2		29.	41 7	28 7	20 10	35 2	36 0		
9.	44 9	27 11	23 1	31 2	34 0	36 2		July 6.	41 8	28 0	21 7	36 11	36 8		
16.	45 2	30 3	22 7	30 8	35 0	34 10		13.	42 6	30 4	21 10	38 5	38 6		
23.	45 7	30 0	22 10	31 5	34 3	36 11		20.	42 7	30 1	21 5	41 4	42 2		
30.	46 7	30 4	23 5	34 0	35 7	37 8		27.	41 3	30 7	21 9	42 3	43 2		
Aug. 6.	46 2	30 6	24 8	33 6	31 9	37 5		Aug. 3.	40 7	30 6	21 8	41 0	42 6		
13.	46 8	30 9	23 8	32 2	39 1	41 5		10.	40 7	30 8	21 4	42 1	43 4		
20.	44 11	32 6	23 8	29 0	35 8	40 9		17.	40 8	31 1	21 2	42 2	43 6		
27.	44 7	35 11	24 2	29 7	38 0	41 6		24.	40 8	30 11	21 10	40 3	41 6		
								31.	39 4	31 4	22 0	39 0	40 4		

LIVERPOOL.								DUBLIN.							
Date.	Wheat.	Barley.	Oats.	Rye.	Pease.	Beans.		Date.	Wheat.	Barley.	Oats.	Pease.	Beans.		
s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.		s. d.	s. d.	s. d.	s. d.	s. d.	s. d.		
1864.								1864.							
June 4.	37 0	28 10	20 4	28 6	34 2	34 6		June 3.	24 0	15 6	13 4	10 6	18 6		
11.	37 4	27 6	20 9	28 2	33 6	34 8		10.	24 8	15 9	13 6	10 8	18 4		
18.	37 0	26 1	17 6	28 0	34 4	33 8		17.	24 4	15 8	13 2	10 9	18 3		
25.	37 10	26 6	18 7	27 10	34 10	35 6		24.	23 6	15 0	13 0	10 10	18 2		
July 2.	38 10	26 8	18 5	28 2	36 8	36 3		July 1.	23 8	15 8	13 1	10 11	18 1		
9.	41 8	26 2	22 9	30 4	35 10	36 6		8.	24 0	15 2	13 2	10 7	18 3		
16.	41 6	28 4	23 2	31 2	36 1	35 4		15.	23 6	15 4	13 1	10 8	18 4		
23.	39 8	28 6	23 6	30 4	35 6	36 2		22.	25 0	16 0	13 6	11 8	18 6		
30.	41 1	29 8	24 2	31 8	34 8	37 2		29.	25 2	15 6	12 6	11 8	18 6		
Aug. 6.	44 0	30 2	25 4	32 4	33 2	36 6		Aug. 5.	25 0	15 4	12 10	12 0	18 6		
13.	42 0	31 6	26 1	31 6	35 2	38 6		12.	24 6	15 2	12 9	11 10	18 4		
20.	42 3	32 4	26 3	30 4	36 1	40 2		19.	24 0	15 6	13 0	11 8	18 3		
27.	39 10	33 6	25 6	29 4	37 6	40 4		26.	23 9	16 3	14 6	11 8	18 0		

TABLE SHOWING THE WEEKLY AVERAGE PRICE OF GRAIN,

Made up in terms of 7th and 8th Geo. IV., c. 58, and 9th and 10th Vict., c. 22. On and after 1st February 1849, the Duty payable on FOREIGN CORN imported is 1s. per quarter, and on Flour or Meal $\frac{1}{4}$ d. for every cwt.

Date.	Wheat.		Barley.		Oats.		Rye.		Pease.		Beans.	
	Weekly Average.	Aggregate Average.	Weekly Average.	Aggregate Average.	Weekly Average.	Aggregate Average.	Weekly Average.	Aggregate Average.	Weekly Average.	Aggregate Average.	Weekly Average.	Aggregate Average.
1864.												
June 4.	38 11	39 2	29 6	29 9	19 10	19 8	28 4	29 5	33 5	32 7	34 10	34 3
11.	39 6	39 3	27 11	29 4	20 0	19 9	30 1	30 4	33 9	32 9	34 10	34 5
18.	40 0	39 8	28 0	28 7	20 8	20 1	30 6	30 10	33 3	32 1	35 5	34 10
25.	40 8	39 6	27 6	28 10	20 4	19 11	32 8	30 6	33 9	33 0	35 5	34 8
July 2.	40 9	39 10	27 2	28 2	20 9	20 3	31 2	30 9	34 0	33 4	36 2	35 2
9.	41 9	40 2	27 8	27 11	21 10	20 7	28 2	31 0	32 8	33 6	36 1	35 6
16.	42 6	40 9	27 10	27 8	21 7	20 10	31 5	31 7	34 3	33 7	36 11	35 10
23.	43 0	41 4	27 8	27 7	21 0	21 0	34 0	31 7	35 7	33 11	37 3	36 3
30.	44 0	42 0	27 7	27 7	22 4	21 4	30 2	31 1	36 11	34 3	38 4	36 9
Aug. 6.	44 1	42 8	28 8	27 7	22 10	21 9	33 0	31 5	35 3	34 7	39 2	37 5
13.	43 6	43 2	28 1	27 9	22 0	21 11	32 9	31 6	36 9	35 1	39 8	38 0
20.	42 7	43 3	28 7	27 11	22 11	22 1	31 6	32 2	35 5	35 6	40 9	38 9
27.	42 5	43 8	29 1	28 2	22 0	22 2	32 8	32 4	35 6	35 9	41 1	39 5

FOREIGN MARKETS.—PER IMPERIAL QUARTER, FREE ON BOARD.

Date.	Markets.	Wheat.		Barley.		Oats.		Rye.		Pease.		Beans.	
		s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.
1864.													
June ..	Danzig	20	6-25	6 16	0-20	6 11	6-14	0 18	0-23	0 26	0-30	0 25	6-30 0
July ..		21	6-26	0 16	0-21	6 12	0-14	6 18	6-24	0 26	6-30	6 26	6-31 6
August.		22	0-26	6 16	6-22	6 12	6-14	6 18	0-23	6 26	0-30	0 27	6-32 0
June ..	Hamburg	21	0-26	0 16	6-20	6 12	0-14	6 18	6-24	0 25	6-29	6 26	0-30 0
July ..		22	6-27	6 17	6-22	0 12	6-15	0 19	0-25	0 26	0-30	0 26	6-31 6
August.		23	0-28	0 18	0-23	6 13	0-15	6 19	6-25	0 26	6-30	6 26	6-32 0
June ..	Bremen	21	0-26	6 15	6-19	6 11	6-14	6 17	6-22	6 24	6-28	6 24	6-29 0
July ..		22	6-27	6 17	6-20	0 12	0-14	6 18	0-23	0 24	6-28	6 25	6-30 6
August.		21	6-27	6 16	6-21	0 12	6-15	0 18	6-23	6 25	0-29	0 26	0-31 6
June ..	Königsberg	21	6-26	6 15	6-19	0 11	0-14	6 16	6-22	0 25	0-28	6 24	6-30 0
July ..		22	0-27	0 16	0-20	0 11	6-14	6 17	6-22	6 25	0-29	0 25	0-30 6
August.		21	6-26	6 16	6-20	6 12	0-15	0 18	0-23	0 25	6-29	6 25	6-31 6

Freights from the Baltic, from 5s. to 7s. 6d.; from the Mediterranean, from 10s. 6d. to 12s.; and by steamer from Hamburg, from 5s. to 6s. per imperial qr.

THE REVENUE.—FROM 1ST APRIL 1864 TO 30TH JUNE 1864.

	Quarters ending June 30.		Increase.		Decrease.		Years ending June 30.		Increase.		Decrease.	
	1863.	1864.					1863.	1864.				
	£	£	£	£	£	£	£	£	£	£	£	£
Customs	5,857,000	5,446,000	..	..	411,000	24,100,000	22,321,000	..	..	1,779,000	..	..
Excise	4,405,000	4,864,000	459,000	..	..	16,674,000	18,668,000	1,992,000	..	..	..	..
Stamps	2,394,000	2,589,000	145,000	..	..	9,135,000	9,462,000	327,000	..	..	..	..
Taxes	1,390,000	1,432,000	42,000	..	..	3,183,000	3,260,000	77,000	..	..	..	..
Post-Office ..	950,000	960,000	10,000	..	..	3,750,000	3,820,000	..	..	2,078,000	..	..
Miscellaneous	576,204	564,200	..	13,004	..	3,128,861	3,328,959	70,000	..	..	..	..
Property-Tax	2,918,000	2,469,000	..	449,000	..	10,713,000	8,635,000	200,098	..	..	..	..
Total Income	18,440,204	18,324,200	656,000	872,004	..	70,683,861	69,492,959	2,666,098	3,357,000	..	..	..
Deduct increase .....	..	..	656,000	..	..	..	..	..	..	2,666,098	..	..
Decrease on the qr. ..	..	..	..	216,004	..	Decrease on the year	..	..	..	690,902	..	..

PRICES OF BUTCHER-MEAT.—PER STONE OF 14 POUNDS.

Date.	LONDON.		LIVERPOOL.		NEWCASTLE.		EDINBURGH.		GLASGOW.	
	Beef.	Mutton.	Beef.	Mutton.	Beef.	Mutton.	Beef.	Mutton.	Beef.	Mutton.
1864.	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.
June...	7 6-8 6 7 9-8 9	7 0-8 3 7 9-8 6	7 0-8 3 7 9-8 6	7 0-8 3 7 9-8 6	7 0-8 3 7 9-8 6	7 0-8 3 7 9-8 6	7 0-8 3 7 9-8 6	7 0-8 3 7 9-8 6	7 0-8 3 7 9-8 6	7 0-8 3 7 9-8 6
July...	7 9-8 9 8 0-9 3	7 3-8 6 8 0-9 3	7 3-8 6 8 0-9 3	7 3-8 6 8 0-9 3	7 3-8 6 8 0-9 3	7 3-8 6 8 0-9 3	7 3-8 6 8 0-9 3	7 3-8 6 8 0-9 3	7 3-8 6 8 0-9 3	7 3-8 6 8 0-9 3
August.	8 0-9 0 8 3-9 6	7 6-8 9 8 3-9 3	7 6-8 9 8 3-9 3	7 6-8 9 8 3-9 3	7 6-8 9 8 3-9 3	7 6-8 9 8 3-9 3	7 6-8 9 8 3-9 3	7 6-8 9 8 3-9 3	7 6-8 9 8 3-9 3	7 6-8 9 8 3-9 3

PRICES OF ENGLISH AND SCOTCH WOOLS.—PER STONE OF 14 POUNDS.

ENGLISH.		s. d.	s. d.	SCOTCH.		s. d.	s. d.
Merino,	in grease,	25 0	to 31 0	Leicester Hogg, .....	..	30 0	to 37 0
South-Down, .....	..	20 0	.. 25 6	.. Ewe and Hogg, .....	..	25 0	.. 30 6
Half-Bred, .....	..	26 0	.. 32 6	Cheviot, white, .....	..	21 0	.. 26 6
Leicester Hogg, .....	..	20 0	.. 26 0	.. laid, washed, .....	..	15 0	.. 20 0
.. Ewe and Hogg, .....	..	27 6	.. 34 0	.. .. unwashed, .....	..	12 6	.. 16 0
Locks, .....	..	24 0	.. 30 0	Moor, white, .....	..	12 0	.. 16 6
Moor, .....	..	12 0	.. 15 0	.. laid, washed, .....	..	9 6	.. 14 0
	..	9 0	.. 12 6	.. .. unwashed, .....	..	8 0	.. 11 0

ON THE USE OF WHINS, FURZE, OR GORSE.

"THE use of whins! what on earth can the fellow have to say on that subject?" we think we hear some reader exclaim as he cuts up this page of the Journal. He doubtless remembers the hard work he had to get all the gnarled, stubborn whin-roots stubbed out of that old fox-cover which he has "reclaimed," and added to the cultivated part of his farm; and he thinks also of the thick growth of prickly seedlings which are coming up strong and fresh among his young grass on that spot; so that to have "the use of whins" paraded in this way before his eyes seems almost a down-right insult to his understanding.

But "gently over the stones," good friend. An ancient philosopher, but one with whose writings we have no doubt you are perfectly familiar, has left on record that there is "a time to plant, and a time to pluck up that which is planted." We all know there are things which are not only right and proper in their own place, and are actually eagerly sought for and carefully cultivated under such circumstances, but when these conditions no longer hold good, that those very things become "weeds" and positive nuisances. A luxuriant field of potatoes is a very nice thing; but the growth of missed tubers amongst the wheat crop which follows, is by no means so pleasing an object. Oats are very good when grown as a crop; but the produce of undigested corn which has got into the manure, and springs up in the drills of potatoes or turnips, is cut out without remorse as being out of place, and therefore offensive. So it is with many other matters: keep them in their own places, and they are all right; but let them appear where they are not wanted, and forthwith every means are taken to eradicate and destroy them. Though a growth of young whin plants in a grass field is not desirable, yet it may be just the very thing under other conditions; and that such is frequently the case we hope to prove before we have concluded this article.

It has been long known that horses, cattle, and sheep are not only particularly fond of the young shoots of whins as food during winter and spring, but also that they thrive remarkably well upon this kind of food. It is necessary, indeed, to prepare even the comparatively soft shoots before these are given to horses and cattle, but sheep eat them without any preparation, as may be seen by the state of whin-bushes growing on sheep pastures, for such are as neatly trimmed, as if dressed with the hedger's shears. But, although the use of whins as food for live-stock is by no means a modern discovery, it is not so generally turned to account as one would suppose might be the case, even in those parts of the country where whins would grow freely, and where considerable difficulty is often experienced in carrying stock through the winter and spring

months. Still, there are parts of the kingdom where whins are used as food for stock to a considerable extent, and we have reason to know that their use for this purpose is even extending. Why it is not more generally the case, at least under suitable circumstances, is hard to say. Probably it has arisen from the fact that many persons, while engaged in the improvement of land, have found a great obstacle to their operations in the presence of large tracts of old, coarse whins, which have abounded in waste land prior to their reclamation; and that, in this way, a sort of undefined prejudice has arisen against whins. Being of opinion, however, from observation and actual experience, that a considerable amount of benefit may be derived from the use of whins, we propose to lay before our readers certain evidence which we hope will satisfy them we are right, and also lead them to regard this usually despised plant with somewhat more consideration, in an economical point of view, than it has hitherto received.

"The beautiful furze, gorse, or whin of our hills and commons," says Dr Hogg, in his 'Vegetable Kingdom,' "is the *Ulex Europæus*. Although so plentiful in Great Britain, there are many parts even of Europe where it does not exist. It does not grow in Sweden or in northern Russia. In some parts of Germany it is not known to exist, and in the south of Europe it is not met beyond Provence. It was with difficulty that Linnæus preserved a living plant of it in a greenhouse at Upsal; and it need not therefore be wondered at that, when he first visited this country and saw our hillsides and commons robed in gold, he was so enraptured with the sight that he fell on his knees by the side of a furze-bush, and thanked God for its loveliness." Horace Smith, too, has sung "the charms of untrumpeted furze;" so that although many look upon it with aversion, it has inspired others with admiration:—

"It is bristled with thorns, I confess—
But so is the much-flattered rose;
Is the sweet-brier lauded the less
Because among prickles it grows?
'Twere to cut off an epigram's point,
Or disfigure a knight of his spurs,
If we foolishly wish to disjoint
Its arms from the lance-bearing furze."

But it is with the "use of whins" we have to deal, and must leave its beauties and the moral lessons it conveys to botanists and poets; and, in illustration of the subject, we shall proceed to quote some practical evidence of its value as food for live-stock.

In the fifth volume of the 'Transactions of the Highland Society,' Mr Fraser Tytler gives his experience of the use of whins in feeding horses, as ascertained by him during the years 1812 to 1815 inclusive. Mr Tytler evidently laboured at first under a dread of being laughed at, but as he had abundance of whins on his farm, merely involving the cost of preparation, he wisely determined to

experiment on a small scale with what some people, at least, believed to be a useful article of horse-feed. A small quantity of the young shoots was collected, and, after being bruised, were put into the mangers of two stalls before his horses came in from their morning's work. The result was that the horses, having at the same time hay at command in the rack, preferred the bruised whins, although they had never previously touched food of the kind, and finished the bruised whins before they "laid a mouth" on the hay. This was proof positive; but in order to confirm it, or to try whether the first pair were singular in their tastes, he next day caused a feed of the same sort, weighing from two to three pounds, to be put in the mangers of eight farm horses, the result being precisely similar to that which was obtained on the first trial. In order to try the tastes of his horses a little further, he put oats in one end of the manger and bruised whins in the other. In this case the horses showed considerable indecision. They would sniff at the whins, and take a mouthful, then attack the oats, which, on the whole, they seemed to prefer; but no sooner had they done with their allowance of oats than they turned to the whins and cleared them out also. This settled the matter; and having no longer any fear of ridicule before his eyes, Mr Tytler put his whole farm stable establishment on this description of food, assisted by a limited supply of oats, and some straw or hay; and he stated that the horses continued to manifest the same relish for the whins as at first, at least until about the middle of March, when the shoots became less succulent, and therefore less palatable than at an earlier part of the season. After the horses had been fed regularly with whins for six weeks, their coats became as sleek and fine as if they had been sweated under body-clothes; and they not only kept but improved their condition during the whin-feeding season, although performing some of the severest work done on the farm.

When Mr Tytler had sufficiently tested the value of whins, and established the use of them as food for his horses, he commenced the whin-feeding season in October, and continued it, as we have stated, until the middle of March. The system pursued by him during the years mentioned above was as follows:—In 1812, being the first year he commenced the practice, the horses had, along with their whins, as much straw as they could eat, and 3 lb. 2 oz. of oats per day till the beginning of February, when their allowance of oats was doubled. The quantity of bruised whins given per day was found, upon an average, to be 18½ lb. The same system was continued in 1813. In the following year the stock of horses was reduced to eight, and a larger quantity of whins was given them. Six of the horses got each 28 lb., and the other two horses from 20 to 22 lb. Corn was withheld from them during the short days of winter; and in spring, as the days lengthened, and the work became heavier, they got only half their former allowance, or 3 lb. 2 oz.

Notwithstanding that the allowance of oats was thus materially lessened all through the season, the condition of the horses was equal, if not superior, to what it had been during previous years—the quantity of corn withdrawn appearing to be more than compensated by the additional 10 lb. of whins.

The expense which attended this mode of feeding, including that of collecting and preparing the whins, together with straw and oats, was 4½d. per day for each of the eight horses prior to the beginning of February, when no corn was given, and 8d. per horse after that date, oats being then added. When hay was given instead of straw, the daily expense was 1s. 0½d. per horse.

“A Welsh Farmer” gave his experience on “the use of gorse for winter keep,” in the ‘Mark Lane Express’ of October 31, 1864; and in order to show how closely the expense approximates to that given by Mr Tytler, notwithstanding the number of years which have elapsed since that gentleman’s report was published, we give the “Welsh Farmer’s” letter as it appeared in the journal we have named:—

“The certain deficiency in the supply of hay and roots for the ensuing winter renders every hint respecting the use of a substitute of importance. Allow me, therefore, to give your readers a little *practical* information with regard to the consumption of furze or gorse as winter keep.

“In the neighbourhood where I reside, almost every farmer maintains the whole of his horses upon it (with the addition of a little corn) during the winter months. It is prepared by being passed through a machine formed of a spiked roller passing between “combs” of spikes attached to the framing enclosing the whole, and is generally worked by a small water-wheel, although I see no reason why steam or horse power may not be applied. It is very simple and inexpensive (about £7 or £8), and reduces the furze to a pulp that may be squeezed in the hand with impunity. As a proof of the great economy effected by the use of this food, I may state that I winter ten horses, which consume three and a half cart-loads per week. These cost from 1s. 6d. to 2s. per load; the cutting is done by the job at 1s. 6d. per load, the man also assisting the carter in loading. It is bruised after field hours in the same time that would be required to cut the necessary amount of chaff. The cost of keeping all my horses is therefore as follows:—

Three loads and a half of furze at (say) 2s., . . .	£0	7	0
Cutting and loading three and a half, at 1s. 6d., . . .	0	5	3
Carting home, half-day each load, at 5s. per day, . . .	0	8	9
Ten bushels oats, at 2s., . . .	1	0	0
	<hr/>		
	£2	1	0

Not quite 4s. 1½d. per horse per week.

“I may add that the horses are worked hard, and kept in good condition.”

The “Welsh Farmer” gives more oats to his horses than Mr Tytler did, but still his daily cost per horse is not more than 7d. for oats and whins.

It may be interesting to mention, that Mr Tytler states, on the authority of Lieutenant-Colonel Macgregor, that the forage used by the horses of the British army under the Duke of Wellington, while

in the north of Spain and in the Pyrenees, consisted chiefly of whins, on which they were found to thrive remarkably well :—

“The whole of the regimental horses and mules of the division were fed on whins: they were mostly given to them at night when doing them up, and the quantity given them was as much as they could eat during the night. They occasionally got a small allowance of corn, and were turned out to browse the whole of the day when not wanted; but what they then picked up could not have affected them much in point of nourishment, it being then winter, and numbers feeding on the same spot for a length of time. The period during which whins constituted the principal part of the food of these animals, was from October till March. During a great part of the time of feeding them in this way they had but little work to do, and they improved in condition, having fallen off much before by their great fatigues and privations; and on the army advancing to Bayonne, the animals did their work well.”

In the ‘Quarterly Journal of Agriculture,’ the first series of this Journal, we find Mr Robert Black, Lochalsh, Ross-shire, reporting in 1838 his experience of whins as food for live-stock. Mr Black’s attention had been directed to the matter by a Warwickshire gentleman, on whose property whins or gorse was cultivated to a considerable extent; and he proceeded to make several experiments on raising what is called in Ireland “a furze-meadow” at Lochalsh, the results in some cases being unsatisfactory. He succeeded, however, at last, and we shall give the details in his own words:—

“From the hints gathered from past experience, I plainly saw that wherever the gorse had moderately dry soil, somewhat free from grass and weeds, it succeeded to satisfaction. In the winter of 1835 and spring of 1836, I had, therefore, a bog of 16 Scotch acres drained and dug over to the depth of 10 or 12 inches, at an expense of £6 an acre. The land at the time of sowing, April 1836, I considered in a very unfit state for sowing, as the raw peat had had no time to mellow down to anything like soil, and the seed was consequently sown over a raw peat-bog, showing symptoms of pulverisation only where the peat had happened to be more or less mixed with other matter. Contrary, however, to expectation, the seeds vegetated freely, and by October had reached the height generally from 4 to 6 inches. The severe spring of 1837 cut off by the ground many of the plants that had been unnaturally drawn up by shading or otherwise; but these all sprang again from the root, and are now the thickest and most luxuriant parts of the field.

“At the present date, 15th January 1838, we have been cutting gorse for two months back, and during that time have kept eight horses, young and old, *wholly* upon them; as also about the same number of cows partially so. The horses are in the yoke every day, and are in excellent condition, although they have not tasted oats this season. The cows have also improved both in milk and condition since we began to give them a feed daily. From what I have seen of the feeding qualities of gorse, I have no hesitation in saying that I consider it equal to both oats and hay for work-horses, and superior to any kind of food that is usually given to milch cows in winter; the butter and milk from cows fed on it being equal to those from the finest old pastures during the best part of summer.”

About the very time when Mr Black was thus recording his experience of whins—we like this name better than the others—a heavy snow-storm came on, and lay thick and deep over the ground

until at least the end of March, in that part of Scotland where the writer was then living. In fact, he had to put the harrows over the snow-wreaths in the month of April, in order to break the hard, glazed surface, so that the heat of the sun might have more effect in melting the snow, and thus enable him to get the ploughs to work. For weeks the horses stood almost idle in the stables, as, with the exception of carting out dung, and now and then bringing in a stack to the barn, there was not a thing for them to do. On one part of the farm there was a piece of waste land, which was destined to be reclaimed, covered with whins, and fodder of all kinds being scarce that winter, some of the neighbours who held small farms asked permission to cut the whins for their horses and cattle. The writer at that time did not know the value of whins so well as he now does, and the permission was given. The result was, their horses and cows were sleek and fresh when he could only keep his horses in decent condition by means of a liberal expenditure of oats and hay. That was the first thing which opened his eyes to the value of whins; and now, he candidly says, that if a similar permission were asked, he would as soon think of making any one a present of a hay-stack.

The Rev. W. R. Townsend, the venerable rector of Aghada, in the county of Cork, has been zealously engaged for many years in advocating the use of whins as food for live-stock. He has collected a number of his letters on the subject, which had been published in different journals, in a pamphlet,* a copy of which is before us, and it is valuable as giving the experience of a number of persons who have been using whins, some of them for many years. His own experience may be gathered from what he says:—

“I have been for fifty years and more feeding my horses and cows on furze, and I can say, from that long experience, that it is the cheapest and the best food for the autumn and winter months. I have had my horses, getting neither hay nor oats, in more beautiful condition (sleek as mice) than any of my neighbours, though they had costly grooms, the horses fed with the best hay, oats, and beans, and warmly clad. Mine were, perhaps, not as fit for the race-course or the hunting-field, but for road, riding, carriage-work, or the work of the land, they were most fit, though fed only on chopped furze and steamed swede turnips.”

Mr Townsend's estimate, as well as that of others who have used furze, is, that a statute acre will feed from four to five horses or cows during winter and early spring, “without hay, oats, or straw, but with half a cwt. of roots, keeping them in the best condition;” and it is worthy of remark, that all who have given whins to milch cows are unanimous in testifying to the exceedingly rich quality and beautiful colour of the milk and butter—quite the reverse from that derived from cows fed on turnips. In fact, feeding with whins is

* ‘Letters on Furze,’ &c. By Rev. William R. Townsend, Rector of Aghada. Langdon Brothers, Cork.

obviously the receipt how to have summer butter in the depth of winter.

Mr George Bolster, an intelligent county Cork farmer, who states that he was induced to give furze a fair trial from reading Mr Towns-
end's letters, communicates his experience in 'The Irish Farmer's
Gazette' of November 26, 1864, in the following terms:—

"I had much difficulty in keeping my cows through the winter on hay, pasture, turnips, &c., and always with greater difficulty and expense in the spring; but since I have had furze, I am able to increase my stock, and have them in good condition. I now feed forty cows and eight horses at much less expense than a smaller number, and in a much more profitable state. The land I sowed the furze on was of very little use to me; it is now as valuable to me as any of my good land, if not more so; and as the proof of the pudding is in the eating, I have extended its culture, and have now 17 acres of furze, and propose sowing next spring 3 acres more. I had no example of the best modes of cultivation: its value was not known, and it was only sown in bad land badly prepared, and without manure; but now that its value is well ascertained, the ground will get the proper cultivation and breaking up,—if coarse and rocky land, with crows and picks—if good, hand-plough and subsoil-plough, and the proper quantity of manure will be applied before sowing the seed. . . . I sowed the furze with a small seed-sowing machine, and by putting a board under the pipe it is all evenly sown. . . . A very good proof that, as the value of furze is known, it is estimated, is, that many practical farmers in my neighbourhood are cultivators of it, and the more it is known the more its use will be extended."

Mr Bolster further states, that he gives his cows "2½ bushels of prepared furze, with 1 stone of pulped turnips through them at night, and oaten straw in the morning;" that his cows were fed on furze "from 1st of December till 25th of March, and the horses a little longer;" that the value of the land under furze "was not five shillings an acre." The machinery he uses is a £10 Richmond & Chandler's straw-cutter, to cut up the furze, which is then conveyed by an endless web to "a tanner's bark-mill," which bruises it thoroughly. The machinery is driven by a water-wheel, which is also used for driving thrashing and other machinery. The number of hands required to collect and prepare the furze for his 40 cows and 8 horses, are—a man, who "cuts the furze in the meadow, which is brought into the mill by two cart-loads; another man and boy cut [bruise] the furze and pulp the turnips in four hours." He finds that furze is not in any way injurious to in-calf cows, and that it does not render them liable to abort.

A friend of ours, who is a breeder and a very successful exhibitor of short-horns, cultivates whins rather extensively on his farm, and feeds all his stock,—show-stock included,—on the prepared shoots. So convinced is he of the advantage derived from this description of winter green-feeding, that he declares he would not be without it for any consideration; and he believes that the "bloom" manifested by his young cattle in spring is distinctly attributable to their whin diet.

It is almost unnecessary to cite further instances ; but as we consider the subject interesting as well as important, we cannot refrain from giving the substance of a letter received by the writer from an Irish farmer, who has paid great attention to feeding with whins, and has pursued it for several years :—

“ Having used furze as a matter of routine for some years, I do not now keep any note of the quantity given to cattle. When I did, I found that a beast in the stalls can be got to consume as much as 3 stones (42 lb.) in 24 hours, by giving it in three feeds, one of them for the night instead of hay; but, generally speaking, 2 to 2½ stones (28 to 35 lb.) with 3 to 4 stones of roots, and 3 or 4 lb. of meal of some kind. It was found that the best time to give the furze was about an hour or two after the turnips ; if given before the roots they do not take them so well—the reason I suppose to be, that furze is so rich in nutriment that the stomach is satiated, and instinctively the animals abstain. With regard to milch cows and store cattle they get it *ad libitum*.

“ I consider that, economically, there is no food more suitable than furze to yearlings and calves during winter. It holds a middle place between hay and roots, the first being too dry and indigestible for their young organs, and the other too laxative. Accordingly, they are ravenously fond of it—perhaps more so than full-grown cattle.

“ The effect of this feeding is remarkable, which is, that store cattle wintered with it will coat and be in condition to meet the early markets a month earlier than usual—as grass beef, I mean. I find my own experience in that respect confirmed by several gentlemen.

“ Furze has a peculiar sanative property on ill-thriving beasts. One gentleman had two or three years ago an unhealthy heifer, so bad that he determined to part with her at any price ; but having been offered only £4 for her, he determined, on my recommendation, to try her with a course of furze. In two months she recovered so far that he valued her at £10 for the grass ; and she eventually turned out as well, if not better, than the rest of the lot.

“ It was an occurrence similar to this which first led me to use furze in stall-feeding. A beast I had was not doing well, and not being offered a fair price for her in a fair, I tried the effect of furze on her. In a fortnight I got £3 more than I had been offered. Since that time I have always considered it as an essential in stall-feeding, both as being economical and as causing the animal to assimilate other food better. I have never been disappointed in it : moreover, the butcher tells me that they always die better.

“ With regard to horses, I am not very extensive in that way. The benefits of it to them are too well known for me to do more than allude to them. I can only speak as to the economy. So much furze given is so much hay saved, and it never costs more than 10s. or 15s. a ton. A stone weight (14 lb.) is a sufficient feed for the night when well prepared ; if not, the case is different. In the south of Ireland they allow about 4 stones for the night to their horses. This difference I account for in the following manner : They use the chaff-cutters, which leaves it prickly and hard. I have watched their horses eating it ; they appear to be a long time mouthing it, to separate what they find they can masticate, and drop the remainder, at the same time expending a great amount of muscular power in chewing it, besides losing rest. In compensation for this, they require a larger quantity. When it is well bruised, a feed of it is as soon eaten as a feed of oats.

“ I find sheep the least manageable ; they are at any time capricious. In a lot some will eat it, others will not. When snow is on the ground

they take it very well, afterwards they neglect it. I have never found horned cattle refuse it; even when dropped on the grass, they pick it all up.

"When bruised it cannot be kept long; not more than three or four days. It heats and gets fusty. In the first stage of fermentation the cattle rather prefer it. It must be used as fresh from the field as possible, for it soon gets dry, but may be watered in that case to soften it."

Professor Blythe, of the Queen's University, Cork, published two years ago an analysis of furze, as compared with fresh grass and fresh clover. It was as follows:—

	Fresh Furze.	Fresh Grass.	Fresh Clover.
	lb.	lb.	lb.
Total albuminous (or flesh-forming) substances in 100 lb.,	4½	2 to 4	3 to 4
Total respiratory (or heat-producing) do.,	8½	10 to 13	6 to 9
Oil or fatty matter,	2	½ to 1	½ to 1
Woody fibre,	29	10 to 13	3 to 7
Mineral matter (ashes),	4	2 to 3	1 to 3
Water,	51½	60 to 80	75 to 83

Other analyses, made at different periods, show that the young shoots are in their best state for feeding purposes in the month of January. The following analyses show the nature of the mineral matter of furze:—

	M'Calmont.	Furlong.
Potash,	16.49	20.13
Soda,	8.33	6.75
Lime,	15.25	16.80
Magnesia,	8.31	5.27
Phosphates of lime, magnesia, and a little phosphate of iron,	24.34	27.15
Sulphuric acid,	7.50	6.07
Silica,	5.72	5.44
Chloride of sodium,	12.00	12.39

From the nature of whins, as we have said, it is necessary to resort to some means of preparing them for the use of cattle and horses. An old-fashioned, but nevertheless a very effectual, mode of doing this, is described by Mr Tytler as being that which he employed:—

"A circular course of about 8 feet in diameter was paved with coarse flags; an upright post, about 2 feet in height, was fixed in the centre of the course, in the top of which was a pin, which was attached to a spindle or horizontal axle by a swivel working on this pin. The length of the horizontal axle was 12 feet; about 4 feet from the end, attached to the upright post, an old mill-stone was fixed, which revolved with the spindle on the paved course. Mr Tytler afterwards used a stone of much greater weight and thickness. The diameter of this latter stone was 4 feet 2 inches; and its thickness, which was uniform throughout, 17 inches. At the other end of the spindle, a swingle-tree was hung, which was also worked in a swivel. The expense of the whole apparatus did not exceed £5.

"A proper quantity of whins having been spread round in the course of

the stone, the mule was attached to the mill by the swingle-tree, which it drew with perfect ease. The boy followed the stone with a pitchfork in his hand, with which the whins were constantly turned as the stone passed over them. When sufficiently bruised, they were forked into a large-frame wheelbarrow, such as is used for turnips, and the course filled anew with fresh whins. About three hours' work finished the whole; and the food thus prepared was wheeled off to the stable."

About twenty-five years ago, at the Inverness Show of the Highland Society, Dr Mackenzie of Kinellan, Ross-shire, exhibited the working model of a machine constructed by him for the purpose of preparing whins for the use of domestic animals. The following account of that machine was given in the Society's Transactions:—

"The machine used by Dr Mackenzie is of large dimensions, and resembles in every respect the drum and feeding-rollers of the thrashing-machine. The drum is an open skeleton, and the four beaters, instead of being placed parallel to the axis, are curved and placed obliquely, each of the beaters being armed with a sharp-edged steel cutting-knife, as in the common straw-cutter. Immediately under the feeding-rollers there is a square-edged steeled bar (the cutting-bar), firmly fixed to the framework. The cutters, in their revolutions, pass in contact with this bar, and as the furze in passing between the rollers comes to rest on the edge of the bar, it is chopped off in very short lengths by a clipping action between the cutters and the bar. The feeding-rollers are the same as those of a thrashing-machine, the lower one carrying a pinion, which is driven by a spur-wheel placed on the axle of the cutters. To insure the conveyance of the furze to the rollers, an endless web is kept in motion in the position of the ordinary feeding-board by means of a strap from the lower roller. The machine is driven by a motion from the water-wheel of the thrashing-machine.

"In the whin-season, which lasts from October to April, a man with an 18-inch strong scythe will cut in an hour as much whins as may be required for twenty-four hours [for eight horses]. This is carted home to the mill, which, being put in motion, the feeder, with strong gloves or a forked stick, lays the whins regularly on the feeding-board, from whence they are taken by the feeding rollers to the cutters. In less than a quarter of an hour the whole cartload is reduced to short fragments of from $\frac{1}{4}$ to 1 inch in length by passing through the machine."

Dr Mackenzie's machine, it is evident, cut up the soft shoots faster than the old-fashioned millstone set on edge; but we do not consider that the food was as thoroughly prepared by it, especially for cows, as it would be by means of the millstone. Mallets, having cutting blades inserted into them, have also been used, but the process is very tedious, and, unless for small quantities, some more effective machine is necessary. One of these mallets, or rather a rammer, is figured at page 531 of the 'Book of Farm Implements;' and also at page 318, vol. i., of the 'Book of the Farm,' where Mr Stephens states his experiences, with the description of the implement:

"That horses will thrive on bruised whins or furze, I had considerable experience in the winter of 1826, to which expedient I was impelled in consequence of the heat of that summer having burned up the straw of all sorts of grain on light soil. Old whins, growing in a fir plantation, supplied

young shoots from 1 foot to 3 feet in length, which were cut by a field-worker with a hook, and led to the steading, where it was bruised with a rammer, having a shank 3 feet 8 inches in length, a bulged-out part to give the instrument weight, and shod with an iron cutter 4 inches square and 3 inches deep, having its lower edges sharpened, and furnished with three parallel cutters, riveted to it by their ends. Every man bruised with this implement as much furze in the morning on a stone-floor in twenty minutes as served his pair of horses for the day. The horses relished the whins better than hay, and became remarkably fine in condition and coat."

Richmond and Chandler's straw-cutting machines have also been adapted for bruising and cutting whins by means of a change in the gearing; but, on the whole, the most efficient machine for this purpose appears to be that which has been constructed and patented by Mr John Walsh, Stedalt, Balbriggan, Ireland. His machine consists of two or four rollers, formed of a number of saw-toothed disks, working into one another. It is worked either by hand or by power, according to size. It tears up, and at the same time crushes and softens, the whins, so that the prickles are rendered inert, and all parts made more easy of mastication. The average quantity of work done by the machine, even when strong shoots cut off hedge-rows and bushes are used, is 4 cwt. in an hour—putting the stuff through twice, which is necessary when it is being prepared for cattle. When given to horses, one run through is sufficient: at the same time a second run—which is done in half the time the first takes—does no harm.

The most suitable situations for growing whins are steep banks unfit for regular cultivation, or thin rocky land, which cannot be ploughed, and produces little in the shape of pasture. On such spots whins will thrive; and, once sown, and the young plants fairly established, no further care is in general necessary. It is a permanent crop—one of its great merits being that the season for using it is that in which other food is usually scarce and valuable. The ground must be dug or ploughed and harrowed before sowing the seed—of which the quantity allowed varies from 20 lb. to 30 or 35 lb. per imperial acre. When sown in drills 10 inches wide, as some recommend, from 15 lb. to 20 lb. will be sufficient; but when sown broadcast double the quantity will be necessary. Thick sowing causes the plants to be drawn up, and therefore tender, which is of consequence, as the shoots are more easily prepared for use as food. The seed is sown in April, and the plants will be ready for cutting in eighteen or twenty months afterwards. The first cutting is light compared with what will be obtained in the following year. Some cut only half the plants in each year, while others consider this unnecessary, and cut the whole of their "furze-meadow" annually. The seed used for sowing is usually called "French furze." Mr Bolster recommends ground bones to be applied as a manure for whins harrowed in along with the seed, and the analysis of the plant at once shows this to be a suitable appli-

cation. In localities removed from the sea we would also give 3 cwt. of salt per imperial acre.

Those who are unacquainted with the value of whins for feeding purposes will have formed some better idea of the plant and its uses from what has been stated in the course of this article; but we would also remind them that land which is not worth perhaps 10s. an acre, or even half that sum, will, when sown with whins, produce every year, without trouble or expense beyond that of cutting the crop and putting it through the machine, as much food as will be equal in value to from £3 to £12 an imperial acre. We have even heard the crop estimated at more than we have stated—calculating the saving of hay effected by the use of furze; but what we have said should be sufficient to show that the whin is by no means a plant to be despised, and particularly where the conditions of soil and locality, which we have mentioned, are found to exist. A friend of ours has several acres on the side of a hill 600 feet above sea-level, and so thin and rocky that the land would be very dear to any one at half-a-crown an acre; but wherever there is a yard of soil he has whins growing; and thus the produce of his rocky acres renders him wholly independent of a hay-stack for feeding his horses throughout the winter.

For many years whins have been known as a useful plant for the formation of fences, and we frequently see them devoted to this purpose in different parts of the country. But these whin-fences are too often allowed to run wild, and thus the object for which they were intended is defeated.

A report 'On the Whin as a Fence,' by William Bell, Esq. of Hunthill, Roxburghshire, was given some years ago in the 'Transactions of the Highland Society,' in which that gentleman describes various plans taken by him to raise good fences of this kind.

"The first plan tried was in the form of a double-faced 3-feet turf-dyke, with a ditch on each side. This was made betwixt two grass fields in the year 1814, and the whins were sown in two rows on the top. The only fence required was a single bar of paling on the top of the dyke along each side. The whins prospered well, and in three years were a complete fence. At first the cattle, while depasturing in the fields, rubbed the sides of the dyke, but some of the longest plants being pinned down along the side when the hedge was switched, the whole dyke was so completely covered that it could not be seen.

"It is obvious that this form of fence, occupying much ground, is suitable only for poor situations, where land is not valuable. It has not, therefore, been much used except for march-fences, for which, by its strength, solidity, and durability, it is peculiarly well calculated. If used in other situations, the best height for the dyke is 18 inches to 2 feet, the breadth at bottom $4\frac{1}{2}$ feet, and at top 2 feet, with ditches to correspond, and one row of whins sown on the top about the 1st of May.

"The whins should be cut every year after the third, in the months of May and June or September and October. The usual form of a well kept thorn-hedge is the best. It is more easily cut than a hedge of thorns alone. The height will depend upon the description of cattle kept; it is often left higher 'than a man can see over—fully 6 feet.'"

About 4 lb. of seed will sow a single line a mile in length; but instead of the period mentioned above as suitable for cutting whin-hedges, we would prefer beginning in November, and continuing the operation through the winter, in order to have the benefit of the cuttings for feeding stock, as we know is done on a farm of 600 acres, where whin-hedges are abundant, and where the cuttings, by the by, are prepared for use in a somewhat different manner than anything we have as yet mentioned. On the farm to which we refer, cooked food is used largely; and the whin-shoots, after being bruised, are mixed in alternate layers with chaffed hay or straw and sliced roots in long boxes. When the boxes are filled, hot water is poured into them, after which a close fitting lid is put on each box, and the contents are allowed to remain until they become sufficiently cooked for use. A manifest advantage is found from the addition of bruised whin-shoots to the other materials.

We have thus endeavoured to describe the uses to which a plant which is not uncommonly considered a nuisance may be put with advantage. We know that whins are valuable as food for stock, but we do not therefore say, Lay down your best land under whins as a permanent crop; although we have been told by some who use them that their best land is not too good for the purpose, considering the advantage of having such a supply of winter food. But we would be glad to see whins properly *cultivated* on many poor spots which at present are of very little value, but which, if devoted to the growth of this plant, would become of much importance to those who have such spots on their farms; provided, also, that the young shoots are regularly used every winter, so as to prevent the plants from becoming coarse and wild.

COFFEE : THE SCIENCE AND PLEASURES OF ITS CULTIVATION AND USE.

How to make money by a side-wind as it were—that is, when enjoying life all the while—is a problem which it is well worth knowing how to solve. Who doubts it? And why do we give so trite an observation a place here, especially such a place—the opening sentence of a scientific, but we hope not unreadable, article on coffee—the science and pleasures of its cultivation and use. The fact is, many men propose to themselves merely the problem how to make money anyhow. The drudgery, the limitations, the disagreeables implied in their proposed method they never look at. Money—merely money, under the cover of some specious name, such as “a fortune”—is the exclusive object of their regard. Like some professed theologians who of late have found the whole Gospel in

Shakespeare generally, they too find their gospel in Iago's words, when he gives as his charge to Roderigo—

"Put money in thy purse . . .
Put but money in thy purse . . .
Make all the money thou canst . . .
Go to ; farewell ! put money enough in your purse."

Now let us invent the best excuse possible for the exclusive pursuit of money : let us say, for instance, that it is merely one of the many forms in which the intellect manifests its love of unity—a love which, like love in general, is ever apt to lead to extravagance and error—yet it is manifestly very absurd for any one to propose to himself nothing higher for life than merely the scraping together anyhow of a heap of money, call it "a fortune" or by any other name.

With this absurdity no cultivator can be charged, whatever the kind of seed that he commits to the soil, whatever the labour he has bestowed upon the soil which he has prepared for the reception of that seed. The cultivator has chosen for himself a manner of life which is both an art and a science, and which, therefore, ought to be a source of high enjoyment in itself, all independently of its money-proceeds. Moreover, it cannot be an unpleasing thought to any man that he has resolved to devote his life to a pursuit which has for its object the healthful sustenance and enjoyments of others. Still, who will deny that money is of great value (though not the very measure of value, as has been sometimes supposed), conferring as it does on its possessor, to such a wonderful extent, "the power of lifting," and so of realising his likings, his life, and his liberty? But, as it was beautifully said long ago,—

"Omne tulit punctum qui miscuit utile dulci."

so may we say now, as indeed we have said already, that what commands the unanimous vote at once of reason and religion, is a vocation in life, such that one can make money in it by a side-wind—that is, while rightly employing and enjoying life at the same time. That must be universally conceded ; but how to do so, the question remains. And, to solve it, every one (save those only who follow in the smooth wake of hereditary rights) has to think and to plan for himself.

Of all the questions which spontaneously present themselves, one of the first is—life at home or abroad? And here the major part, no doubt, of those who propose to become cultivators content themselves with the prospects of home cultivation. They have been in no degree fascinated with the lessons on geography learned at school. They look upon all the world except their native country as outlandish. And if the law of inheritance has not put them in possession of paternal acres, they aim at the nearest substitute—viz., a nineteen years' lease. But others, perhaps at school, have been touched by what they have come to know of foreign countries ; and as they themselves grow, they have a growing demand to go

abroad. And the time comes when they do go. And where? The greater number, actuated by a belief that there is greater safety to life and security of success in temperate climates, keep nearly in the parallels of their native land. They go to Canada, Australia, New Zealand, &c. A lesser number venture nearer the line, the East or West Indies, China, Ceylon, &c., consenting, while they make their choice, to run greater risks, especially, as they apprehend, to life itself, which is of course the risk of all risks.

Now, we think it safe and important to state that the dangers to life attaching to a residence within the tropics—at least for such a period as may be considered long enough for realising a fortune—are usually greatly exaggerated. Supposing the climate of residence to be merely tropical, and not specifically unhealthy, by far the greater number of deaths that occur among the young or middle-aged are the consequences, not of climate merely, but of some notable indiscretion, some flagrant violation of the laws of health—over-exertion, over-drinking, or over-eating,—usually all the three. The truth is, that when the temperature of the external atmosphere approaches so nearly to that of the living body as it does in a tropical climate, a degree of caution in all the proceedings of everyday life is necessary for which there is no occasion in temperate climates. At home, however much one may exert himself, it is long before he becomes injuriously over-heated; or if he have overheated himself, the difference between the heat of his body and that of the external air is so great, that he is usually cool again before inflammation or any derangement in the blood or brain has had time to establish itself. But when the temperature of the air is only a few degrees below that of the blood, as it sometimes is in tropical climates, heat is carried away from the body very slowly. One overheats very easily and very fast; and when once over-heated, one takes a long time to cool again, and longer repose and more patience than most people possess; and hence the origin of all the peculiar risks of life within the tropics. The over-heated state, implying as it does a diffusion of blood all over the surface, implies a deficiency about the heart. Hence a feeling of great discomfort, a feeling of faintness about the præcordia, a want about the stomach—and, in all ordinary cases, a demand for a stimulus—and as usually the most handy and the most agreeable, a glass of brandy-and-water or a glass of bitter beer. And such, generally speaking, is the comfort which follows a draught of either, that it enables the party who has had it to resume his work. Then he has another glass, and another—and so on all day long. And thus, in a multitude of cases, there is formed, quite insidiously, a habit at once of over-acting and of over-drinking. The same condition of the system leads also, in reference to food, to a demand for highly-seasoned dishes. Plainly-dressed food is inadequate to recall the blood to the stomach, and fails to relieve from the feeling of exhaustion and faintness. Within

the tropics only highly-seasoned food has a peculiar relish. And hence a temptation to excessive indulgence in eating. And thus a state of general congestion is apt to be induced, which, telling in the brain, the liver, the spleen, the colon, prepares for sun-stroke, liver disease, jungle fever, and dysentery, the great scourges of tropical life.

The prevention usually recommended is temperance in all things; and truly that recommendation can never come amiss, and can never be followed without advantage. It is wholly inadequate, however, in so far as tropical life is concerned, when it looks only to temperance in eating and drinking, and not in bodily action also. To expect a fellow with a face as red as fire, and flushed to a degree, who has just legs enough to be able to stagger into his bungalow and throw himself upon the couch, to wait patiently till he cools spontaneously in the course of nature, when he knows that there is the brandy-bottle and plenty of Bass in the cellaret or ice-safe, and that he has only to sing out, in order to have a glass in a moment, is out of the question. Not one in a hundred has the firmness to resist and to endure his existing faintness; not one in another hundred would allow himself the time required for a spontaneous cooling, and a recovery of muscular energy and comfort in the course of unassisted nature. Indeed it is very far from certain that abstinence in such a case would be the right practice. The restorative power of brandy-and-water, or of bitter beer, in such a case, cannot be denied or honestly explained away. Still it is no less true that the excessive and habitual use of these liquors proves eminently destructive—brandy especially—and so insidiously in the tropics, that we have known several cases where worthy gentlemen who had never been known to be drunk in their lives, have to their own surprise, and that of all who knew them, been stricken with *delirium tremens*. The habit of soaking the system with bitter beer, also, has been found to be decidedly deleterious. What, then, is to be done? Shall we *denounce*, and that *in toto*, articles which, when taken judiciously, are, by all the evidence that can be obtained, distinctly restorative, and possess a food action? No; but nevertheless we would recommend the European sojourner within the tropics, who has laid his plans to come home with a constitution in full vigour, to *renounce* them. And for this reason, that when he knows that if flushed and over-fatigued he is not to have them, he will soon learn to avoid the over-action which, without them, will bring him great discomfort, and make him useless perhaps for hours.

But why, it may be said, care for flushing and exhaustion, when a glass of brandy-and-water or of bitter beer can restore comfort, strength, and coolness, in less than half an hour? The reason is, that by such indulgence in over-acting and over-drinking day after day, an atmospherical is converted into a high-pressure engine, and

it is nine chances that something in the machinery will soon go wrong, or the engine break down altogether. But let a man regulate his business so as to economise his strength and avoid flushing and over-heating, and attend to the other well-known laws of hygiene which are imperative in all countries, and we believe that his probability of life for a long period—say for twenty years—will be as good as if he were at home. And, in point of fact, is it not true that a large proportion of our aged gentlemen at home are old Indians?

But while we thus advocate the remaining within the tropics long enough to make a fortune or secure a pension by work done there, we are equally decided as to the unfitness for any European to propose to himself to establish a family there. Even to maintain a European family in existence for a few generations, intermarriage with the natives must be resorted to; and, by all the evidence that exists as yet, it appears that from such intermarriages much more evil than good results.

Our cultivator, therefore, who has a demand for going abroad, if he make choice of the tropics as his destination, must lay his account with coming home again with a fortune, of course! But in case of any mischance in the matter of money-making, he will do well to choose a kind of cultivation, such that, when engaged in it, life will pass agreeably. Now, this is not the case universally. It is not the case with indigo or sugar or cotton cultivation. Indigo demands too much wetness for enjoyment, cotton too much dryness, and sugar too much hard work and chemical puddling; but coffee-planting fulfils the desired conditions in an eminent degree. Viewed apart from its economic object, coffee-planting is nothing else but landscape-gardening in a country which, in a state of nature, must be beautiful, and in a climate which must be salubrious; for the proper sites for coffee plantations are the slopes of mountains whose peaks are lofty enough to secure abundant showers—the mean temperature ranging about 70°, neither falling 5° below, nor rising more than 5° above. And this to the feelings is the most agreeable temperature possible in the open air, when the breeze is stirring, as it generally is, among the mountains. Neither is there anything in coffee cultivation which is disagreeable, when it is looked upon in an economic point of view, or as a money-making concern, unless, perhaps, the pulping process; of which we shall speak presently, and the consequent drying of the parchment coffee. But that process is not nearly so disagreeable or critical as in the case of indigo, where fermentation must be induced also. Nor is it at all anxious or nasty, as in the case of sugar, to the manufacture of which the development of acid is fatal.

The only question is, Whether it be not now too late for a young man to think of turning coffee-planter; whether the market of the

world be not already fully supplied by the coffee estates in existence already? And, indeed, the quantity annually imported into Europe being no less than 270,000,000 lb., there seems reason for apprehending at first sight that surely this supply must be adequate to the demand. And perhaps the question may ultimately come to be, Which of the two can be produced at the smallest cost, a good cup of coffee or a good cup of tea? The latter, according to existing methods in the family, has greatly the advantage over the other in facility of making; tea is therefore more handy. But coffee has a sustaining and a soothing power which excels that of tea. Its infusion, in fact, contains the same elements as that of tea and others besides, which are of real nutritive value. In tea there is little else but theine and tannin, and that peculiar oil to which tea owes its flavour. In coffee, along with theine and tannin—and these, in a good cup, probably nearly the same in quantity as in a good cup of tea—there are considerable percentages of the flesh-and-blood element, caseine, and the nutritious and warming elements of sugar, gum, fat, and aromatic oil. In this country tea has of late been gaining upon coffee, but that plainly in consequence of the notable cheapening of tea which has followed the lessening of the import duty on it, and as a kind of revenge upon its previous high price, whatever becomes suddenly cheap seems for a time to be a bargain; for in other countries the consumption of coffee has been rapidly increasing, plainly indicating that the population will have it as fast as they can afford it. And as its cultivation comes to be better understood, and the cost of its production becomes less, and its price in the provision-shop lower, its consumption will advance. There can be no doubt that it is only the cost of a good cup that limits the consumption of coffee to its present figure. In France, for instance, infusion of roasted chicory-root and beetroot are largely drunk instead of coffee; but the very names which they bear show that they hold their ground in popular taste only because coffee is too dear. If all the three were to be had for the same money, who would prefer a cup of chicory-coffee or of beetroot-coffee to a cup of coffee-coffee? It may be true, and we are not disposed to dispute it, that a dash of chicory mixed with an inferior coffee may improve its infusion, at least in appearance, perhaps in taste, perhaps even in flavour. But neither chicory nor beetroot, nor anything of the kind, can produce the same physiological effects, or serve the same valuable purposes, as coffee. In these respects tea is its only rival, or likely to be. In point of sustaining power or food-action, the coca-leaf of South America appears indeed greatly to surpass both. Not to speak of its powers both in alleviating, and, when taken in excess, of aggravating, the miseries of the Peruvian miners, experiments recently made on its effects in Europe leave no room to doubt the truth of what is affirmed by travellers in South America—namely, that the Indian mail-carriers often travel for three or four

days without any food except coca.* But its value has been ascertained as yet only as "a chew" along with a morsel of alkaline calx similar to the betel pepper-leaf of the natives of tropical Asia, whose food-action is also very great; and there seems but little likelihood of its coming into use in Europe. It is also a very remarkable thing that there is no considerable tract of the earth's surface but it yields some such vegetable product to which the inhabitants of that country have recourse, not only for medicinal purposes, but for the solace of everyday life.† But, so far as appears at present, tea is the only rival which coffee has to fear, at least among those who, in the use of such articles, seek sustenance or food-action, not inebriation. Chicory, of which one hears so much, has no properties which are not possessed by a hundred other roots which, roasted and ground, would all yield equally innoxious infusions more or less or equally agreeable to the palate. But coffee contains a peculiar principle. From the source from which it has been derived it bears the name of *cafeine*. And certainly it was no small homage to the taste of unsophisticated people, and no small triumph of chemistry, when it discovered that the peculiar principle of China or common tea (*viz.*, *theine*) was identically the same with *cafeine*. Nor that only, but also the principle of Paraguay tea, which is drunk by 10,000,000 of people, and of the guarana-bread of the Brazilians, which they regard as an indispensable requisite for travellers, and a cure for many diseases. The leaves of the coffee-shrub also contain a certain quantity of this same principle, and are stated by Von Bibra, in his work on narcotics, to be drunk as an infusion by 2,000,000 of the world's inhabitants. It indeed has been proposed that European cultivators should direct their attention to the leaves of the coffee-plant, with a view to gathering and curing them as tea-leaves are gathered and cured. And if quantity were all that had to be considered, coffee-tea could certainly be grown more economically than true tea; for the leaf of the coffee-plant may be compared to that of the Portugal laurel, while the leaf of the tea-plant is like that of privet—the entire of both plants indeed, especially the latter, very much resembling these familiar shrubs. But it is impossible to have from the same plant, year after year, both the foliage and the fruit. If stripped of both it dies. Nor can the coffee-planter avail himself of the natural fall of the leaf, even though the *cafeine* still existed in it; for the coffee-plant is an evergreen, and leaves are therefore falling continuously all the year round, whenever the young bud in the axil of each, or the fruit, comes to maturity. It is necessary, therefore, to make a choice between the fruit and the foliage, and there can be no doubt that the fruit is the right choice.

* See Dr Anstie on 'Stimulants and Narcotics,' p. 482.

† See Johnston's 'Chemistry of Common Life.'

The progress of scientific cultivation has fully determined that the successful cultivator, whatever the object of his care, must not be too grasping. Nothing is gained in the long-run by carrying off too much from a field in a single year ; for if the fertility of the field is to be permanently sustained, restoration must be made by an extra manuring. And if this be imperative in temperate climates, it is still more so in tropical climates, where manuring to any extent at all is a very difficult problem, and especially in reference to coffee, which is grown upon acclivities and hillsides, and therefore on soils which are never heavy. The utmost that can be hoped for is to maintain the soil in a productive state, where everything that is produced on it is left upon it or returned to it, except the coffee-bean itself. Even this will imply the abstraction from every acre of a fully bearing good estate of nearly half a ton annually, and that of a seed containing a large percentage of nitrogen.

What is actually gathered from the bush, however, is not the coffee-bean, but the coffee-berry—a beautiful fruit, which, from its resemblance to a cherry, is commonly called the coffee-cherry, and is no more like the coffee-bean than a cherry is like a cherry-stone. It differs from a cherry, however, in being oval instead of round, and sessile or stalkless, and studded all round the branchlet in the axils of the leaves. Beautiful is a coffee-bush both in flower and in fruit ! nay, when devoid of both, as has been said, it is like a laurel. The flower is beautifully white, and may be compared, both in appearance and fragrance, to jasmine. And when an estate is in full flower, reposing on the hillside, and surrounded by the dark forest, it fills the eye with its beauty. The finely red cherry consists of a pulp, constituting about half the entire bulk of the fruit, and within this there are usually two coffee-beans, with their flat sides in apposition. And both of these are enclosed in one and the same oval sack, which in general appearance resembles parchment when dry, and generally goes by the name of the parchment. In certain states of the plant, however, and in certain localities at all times, the development of the fruit is apt to suffer arrest. Instead of two beans placed symmetrically together by their flat sides, so as to make an oval-cylindrical body taken together, there is only one bean imperfectly attaining to the same form, by the curling in of its edges. Such coffee is called pea-berry. Considered as a product of nature it is an abortion ; but as hunchbacks among men have often more of genius, more of wit-stuff in their brains, than those that are well grown, so has pea-berry coffee more of those elements which fetch a high price in the market. The quantity produced on a given area is of course smaller ; but in this way the planter is in good measure compensated when his bushes take to bearing pea-berry. The better price makes up for the smaller yield. The pulp of the coffee berry is nice to eat when plucked off the bush. It readily ferments, and may be made to yield an intoxicating beve-

rage and spirit of a very agreeable flavour, as is said to be made of it in Arabia. This utilisation of the pulp has been thought of by the European coffee-planter also; but, like the utilisation of the leaves, this idea ought to be abandoned. Its manufacture belongs to the rudest epoch of cultivation—that, namely, in which the entire berry is dried in the sunshine, and the bean afterwards liberated by pounding. In that case, in a poor country, it might be worth while to mash the entire trash that is over, and manufacture a fermented liquor or distilled spirit from it; but in tropical countries where there is abundance of the saccharine saps of palm-trees, and in temperate climates where there is abundance of grain, the production of fermented liquor and spirits, and the imparting to them of any flavour that the popular taste demands, is so easy, that the profitable manufacture of wine or spirit from the pulp of the coffee-cherry is out of the question. All that the wisest economy suggests as to this and all the refuse of the coffee-bean is, to return it to the field in the fittest state, and at the best season to manure the forthcoming crop. It might be otherwise, however, if the oil on which the flavour of coffee depends could be extracted on the spot—perhaps if the caffeine could be crystallised also—as in that case the difficulty of transport of coffee in bulk, and its great expense, would be avoided. But these are questions that need not be thought of in the present day. Present prices do not oblige the cultivator to embarrass his avocation and diminish its amenities by the effort to utilise every item and compress everything into the smallest possible bulk. Nor is it likely that such a crisis will soon arrive. It would be well, indeed, if among planters there should be one now and then who should find his pleasure in utilising everything, and in putting up his good gear in the smallest possible bulk. In such endeavours there is to some minds a high intellectual pleasure. Great must have been the enjoyment and triumph of the first gas-manufacturer, for instance, who showed to his proprietors that the secondary products completely paid the cost of producing the gas. Such ideas hold a primary place in *manufactures*. But it is different in *cultivation*. The cultivator resides in the midst of his operations. Amenities must be attended to. It would not do to hold one's nose all one's life, nor even to wear a scientifically constructed nostril-compressor. The cultivation of Japan may be perfect (as undoubtedly it is), compared with that of our own country,—that a given area there maintains a much larger number of human creatures than the same area does here. But in effecting this the amenities of life are wholly violated. The nose is set at nought, and the eye is habitually offended. Now this ought not to be. Not but everything that is useful ought to be utilised; but not anyhow. The rule which St Paul gives for the churches is good for the fields also, "Let all things be done decently and in order."

In coffee cultivation there is nothing that is inconsistent with

such a rule. Rather it is such a cultivation, that while the planter is making his fortune he is at the same time called upon to develop the beauty of nature, and to open up new sources of enjoyment to himself. And that this may appear more graphically than it could in any general description, let us here set agoing a coffee estate. And as at present in popular favour for this cultivation Ceylon is in the ascendant, let us set out for that island, intending to spend from ten to twenty years of our life there, less or more, according to the capital or no capital that we can bring with us and invest in the concern. Or if we prefer travelling at home, then let us merely follow in idea some young friend who has a mind to go abroad, and to whom we know, in virtue of his good sense and trustworthy temperance, that we can safely commit the use of our capital. If he be energetic and intelligent as well as temperate, he will soon find that he has a bargain of it at anything under ten per cent.

In somewhat less than a month's time, with an opportunity of setting out several times every month from Southampton, the intending planter finds himself at Point de Galle, in the island of Ceylon, the beautiful seaboard and the lofty summits of the emerald isle having greeted his eye the day before. The next day he, or let us say we (for having done it already, we should like nothing better than to do it again), may be in Colombo, the capital of the maritime provinces; and the day after we may be in Kandy, the capital of the interior and the centre of the coffee country. But the new-comer may spend some days in Colombo both pleasingly and profitably. In Colombo, in fact, much is done to modify the profits of the planter. To Colombo the coffee is sent down from the estate in the parchment. There the parchment is removed by edge-wheels in mills constructed for the purpose; and it is desirable that the planter should see them working, and understand their action, so that, in curing the parchment coffee on the estate, he may do all he can to despatch it in such a state that the parchment may be easily and fully disengaged from the bean. If any scraps of parchment remain adhering to the bean, its money-value is greatly diminished—it is said to be foxy; and two samples of coffee, perhaps of equal value in reality, but such that one of them is thoroughly cleaned, the other not, fetch very different prices in the market; for in coffee, as in all articles of luxury, fancy rules to a great extent. In Colombo, also, one meets with the agents of estates; and it is well for the planter to make the acquaintance of these gentlemen, and of their methods. Not that anything is to be said against them here. So far as we have ever known or heard, they are, as a class, very honourable men. But the method they pursue is very expensive to the planter; and the time may not be far distant when the latter will find it advisable, perhaps necessary, to get on without their aid. Moreover, that method as it stands is at once so gratifying and so accommodating to the planter, that, once in an agent's hands, he is

not likely soon to emancipate himself. Thus, what can be more agreeable than to get money merely for the asking whenever one wants it? Now that is precisely the accommodation which awaits the young planter (if he be reputable, as is supposed) at the hands of his agents. He may run himself quite out of funds; no matter. If his estate be in a good quarter and well attended to, his agent will never scruple to keep him in funds. In fact, the agent runs no risk. All the produce passes through his hands, and he has the adjusting of all the accounts. It is inevitable, however, in these circumstances, when there has been indefinite accommodation and much correspondence and accounting, that the profits of the estate can be anything like what they would have been had the planter in Ceylon conducted his cultivation as an East Lothian farmer does his farm. At present prices coffee can bear the expenses that are laid upon it, but if estates increase at the rate they have been doing of late, within even a few years perhaps, it may not be able to yield fortunes both to planters and agents. And if so, it is instructive to remark that, of the two, the planter must be the first to find his pocket empty, for the agent is always safe. The profit of the estate, if any, is always of the nature of a balance in his hand after all his charges have been satisfied.

But let us up to Kandy; a fatiguing day no doubt, but a most beautiful drive of 70 miles in the mail-coach, such as it is. By ascending the Kadugmava Pass, the scenery of which is transcendent both in beauty and grandeur, we attain an elevation of about 1400 feet above the level of the sea, and reach a degree of coolness at which already coffee may be grown with advantage, but not with such advantage as to compete well with coffee grown at elevations from 3000 to 4000 feet. All around are mountains, often very beautifully formed, often very sublime, and generally clothed with forest to their very summits. Sometimes indeed, especially in certain districts, extensive spaces appear covered with grass merely, the forest having disappeared, except along streams and river-courses. These spaces bear the name of *patenas*. The grass which grows on them is from 4 to 6 feet high, giving out an odour of lemons when its stem is crushed or its blade broken. It bears the name of *lemon-grass*, and yields, by distillation, an oil which has the fragrance of lemons, and which bears in the market the name of *citronella* oil. But the demand for it is small; and the European has but little to say to *patenas*, for they are quite unfit for coffee cultivation. Besides the *patenas*, there also frequently meet the eye on the hill-sides spaces which, instead of growing forest-trees or *lemon-grass* merely, are covered by *coppice*. These are clearings which had been made some years previously by the natives for the cultivation of hill rice and millet, returning again to a state of nature. And of them too, as of the *patenas*, it is to be remarked that they are unfit for the production of coffee. Their position and exposure are often

all that could be wished for that purpose, but their soil is at fault. In fact, when under native cultivation, they have been left long exposed to the sunbeams; and this is as fatal to soil in the torrid zone as it is favourable in the temperate zones. The permanent fertility of a soil, according to the most recent determinations of science, mainly depends on its power of spontaneous nitrification, and of retaining, loosely fixed in it, carbonic acid, the atmospherical production of the slow combustion of its humus. Now these natural processes take effect most fully on meadow-land, with a moderate sunbeam playing over it by day, and a moderate supply of moisture clothing it at night—a state of things to be found in warm, but not torrid climates, nor on the hillsides of tropical countries. In such situations, a vertical sun bearing down upon the soil, if it be naked and fully exposed to the solar influence, torrefies that soil, and soon exhausts it of all but its fixed and mineral constituents. Little or no nitre is formed, and the carbonic acid generated assumes the æriform state almost as fast as it is generated, carrying the organic wealth of the soil along with it. Hence the twofold necessity—first, to commence operations upon soil impregnated as fully as can be had with the vegetable matter accumulated for long generations by the forest that has stood upon it, and yielding for many generations its foliage annually, without itself increasing in size; and, secondly, to conduct operations so as to leave, for as short time as is possible, the soil naked and exposed to the sunbeam. The neglect of this consideration is not only productive of sore disappointment to the planter in all his future labours and hopes, but it has been productive of desolation to immense tracts of the earth's surface which lie under a torrid, or at least a torrefying sun. The ancient inhabitants of the valley of the Ganges, for instance, in pursuit of fuel and materials for house-building and furniture, thoughtlessly cut down the primeval forest around them, supplying its place with crops only so long as they could grow them by their ignorant and indolent husbandry. The consequence is, that the sunbeam has taken possession; and now, for miles upon miles, there is nothing but sand and drought, where in former ages there must have been abundant vegetation and moisture. To ascertain whether such deserts may not be redeemed, is one of the problems which we trust will be solved before long by Anglo-Saxon art and energy.

Meantime, for the coffee-planter who has the primeval forest given him to commence upon, here is a first point in his policy: He must hasten forward his cultivation with the utmost rapidity, so as to substitute as soon as possible the verdure of the coffee-field for that of the preceding forest. Yet it is still more imperative that from first to last he must keep the soil between his coffee-bushes open and clean, so as to admit at all times the free access of the air to the roots of his plants. This point secured, under the shade of thin foliage or the canopy of cloud which the neighbour-

ing mountains spread out to a certain extent over the coffee estates of Ceylon, both nitre and carbonic acid are developed in the soil out of the vegetable matter left in it by the preceding forest, and go directly to nourish the coffee-plants. But if weeds be suffered to grow, as they tend to do to an extent and with a rapidity that are wonderful, they, of course, appropriate the virtues of the soil and climate for their own behoof. The young coffee-plants are starved; and, in fact, a coffee estate, if neglected, would relapse into jungle in a year's time. And hence, taking precedence even of the question of soil itself (provided it be forest land), is the question as to supply of labour and the practicability of the labourers. In Ceylon, the population of the island itself, except for the first part of the process of coffee-planting—that is, for felling the forest—is good for nothing. All the estates are formed and cultivated by labourers imported from the neighbouring parts of India. Hence it was naturally thought that coffee could surely be grown more economically and more securely in those parts to which labour is indigenous. Accordingly, in the Mysore and in Wynaad especially, coffee-planting by Europeans has been set agoing of late years; and the exportation of coffee to foreign ports from these parts has increased fourfold in the course of the last four years. But the difficulties especially with regard to labour have been found greater than were anticipated; and it looks as if the mainland of India would be resorted to only after all the suitable land in Ceylon has been occupied. This limit is, however, fast approaching, and very fortunate are they who are already in possession of good estates, with the near prospect they have of a railway extending between the port of Colombo and the coffee country. This will not only facilitate the import of labourers and cheapen their maintenance on the estate, but furnish a safe and speedy means of the transport of the produce of the estate to the seaside, the want of which at present is the greatest vexation that the planter knows.

It looks as if in India there were going to be a race between coffee and tea—coffee in the south, on the acclivities of the Ghauts, and tea in the north, on the slopes of the Himalayas. The chincona tree also, which yields the bark and quinine, one of the most valuable of all medicines, begins to be cultivated in the same regions. But for full and satisfactory information on these and other ministries to our health or our enjoyments we must refer to Johnston's 'Chemistry of Common Life;' * and for their statistics, and indeed such details as would almost enable a coffee-planter to start on his own knowledge, we must refer to Mr Simmonds's little work, entitled 'Coffee and Chicory.' † Dr Anstie's work on 'Stimulants and

* 'The Chemistry of Common Life.' By J. F. W. Johnston. A New Edition, edited by G. H. Lewes. 2 vols. W. Blackwood & Sons.

† 'Coffee and Chicory; their Culture,' &c. By P. L. Simmonds. E. & F. N. Spen.

Narcotics '* possesses great interest to those who are curious to know what place is assigned by a very philosophically-minded physician of high standing in his profession to articles of luxury or of medicine, which usually go by the names of stimulants or sedatives, such as coffee and tea and tobacco. He maintains with great cogency that that action is twofold, according to the quantity ingested; that when the quantity is not excessive it is a food-action, a vitalising action, beneficial in every respect; but when the quantity is excessive it is a paralysing action, a devitalising action—for intoxication, from its first symptoms to its last stages, he regards as a paralysis of the brain more or less. His views explain the universal practices of mankind; and if they give no countenance to total abstinence as a scientific stand-place, they awake great horror at the idea of drunkenness.

RETROSPECTIVE NOTES ON FARM CROPS AND CROPPING.

No. VI. .

THE next of the cereal crops demanding our attention is oats; that crop, the produce of which was defined by the able, but at times somewhat surly, English moralist, as "food for men in Scotland and for horses in England," but the lurking prejudice of which definition was well met by the smart rejoinder, "Yes, true enough; but *where* will you meet with such men and such horses?" Notwithstanding this depreciating estimate of the value of the oat, the crop is, not only in Scotland but in many parts of England, an important one; in Scotland, indeed, in some districts, it is not second in importance to any of the cereal crops; if behind wheat in the estimation of farmers there, certainly before barley. What we have had to say in connection with the history of wheat and barley, we have again to say in connection with oats; all we know, indeed, of the time and place and manner of their introduction into the category of animal food, is that we know nothing; all is conjecture—and conjecture, moreover, of the vaguest kind. Less frequent mention is made of it in those documents which take cognisance of the other cereals, and in Holy Writ no mention is made of it at all. In the records of Roman history, the same absence of direct information respecting it is noticeable, although a curious indirect, yet sufficiently suggestive testimony respecting it, is met with in the statement or story that the Emperor Caligula, in the very arrogance of wealth, fed his horses with gilded oats, from which, if we like, we may draw a moral of some suggestiveness to us all. Repeating the

* 'Stimulants and Narcotics; their Mutual Relations,' &c. By Francis E. Anstie, M.D. Macmillan & Co.

stereotyped information we possess on the history of the oat—which being met with everywhere when the subject is discussed is excuse enough for its being mentioned here—writers state that its origin may be traced to Persia or Mesopotamia; and in corroboration of this, the fact is stated that Colonel Chesney found growing wild on the banks of the Euphrates a variety of oats, which, although very unlike our oats, Dr Lindley says may yet be their progenitor. Having given this, we give all the information we know as to the history of this crop, and proceed, therefore, to the more interesting, because more practical, details connected with its cultivation.

Oats belong to the class (in the natural system) of monocotyledonous plants, sub-class *Glumiferae*, the order *Graminae*, and the genus *Avena*. The number of species is considerable, some naming them up to fifty; but of these by far the greater number are of no agricultural value as cereals, being in fact but grasses or weeds. This reduces the food oats, so to call them, to the following families, under which all the varieties of oats cultivated in this country are classified: These are (1), *Avena sativa*, or the common oat; (2) *A. orientalis*, the Tartarian oat; (3) *A. brevis*, the short oat; (4) *A. nuda*, the naked oat; and (5) *A. stryosa*, the bristle-pointed oat. The general appearance of the oat is so well known as to require no specially lengthened description. Popularly, the distinction between it and the wheat and barley is, that while in these the grains are congregated round a central stalk more or less closely, the grains of the oat are supported on under stalks, which spread out, branch fashion, from a central stem. More scientifically stated, oats are characterised by "their lax panicles, their too lax membranous glumes, and the smaller number of their florets, each of which has one of its husks or *paleae* armed with a twisted beard or awn." But there is a distinction yet to be noted, distinguishing the varieties of the two first-named species. While the varieties of the *Avena sativa*, or common oat, are distinguished by the grains or glumes being borne upon stalks spreading out from a central branch, tree-fashion, on all sides, the varieties of the species of *Avena orientalis*, or Tartarian oat, are at once known from their glumes or grains being placed on, or proceeding from the main stalk, on one side only; presenting the appearance, indeed, very much of the feather on one side of a common quill-pen. To these two species, the common and the Tartarian oat, belong all the varieties cultivated in this country. What these varieties are we now name briefly here. To the first named of the species, *Avena sativa*, or common oat, belong (1), the Potato; (2), the Sandy; (3), Sheriff; (4), the Hopetoun; (5), the Angus; (6), Blainslie; (7), the late, or common white oat; (8), the Berlie; (9), the Poland. Of these (1), the potato oat is the favourite, and the most largely cultivated. Mr Law-

ton states that this variety was first discovered growing amongst some potatoes in a field in Cumberland, in the year 1788. Another writer in the 'Farmer's Magazine,' in 1803, states that the variety was first imported from South America; a few grains only having been sent enclosed in a larger package containing potatoes, the name was thus given to them. The seed of the potato oat is white, plump, and short; it weighs heavy in sample, from 40 to 46 lb. per bushel, and, if well cultivated, will yield from 6 to 10 quarters to the acre. The yield of meal is in general high, as much as 245 lb. having been obtained from 1 quarter; the average may, however, be put down at 210 lb. per quarter. The straw of the potato oat is of a pale yellow colour, and carries, when well grown, a large "bushy ear." The seeds being very apt in this variety to be shed, the crop should be cut before it is dead ripe, a good indication of the proper degree of ripeness having been attained, being in an equal mixture of the green and yellow colour in the straw. The potato oat is perhaps one of the most remunerative of all the varieties, if grown upon a suitable soil, on which point we shall hereafter have more to say, meantime noticing the second of the varieties of which we have above given a list—namely, the Sandy oat. Mr Lawson states that this variety was discovered in 1824-5 on the farm of Meltown, in Aberdeenshire, by a herd-boy named Sandy Tampuson, who first saw it growing upon a recently-formed bank of soil. His master, Mr Pirie, noticing its value, cultivated it from year to year. The Sandy oat is better for late districts than the potato, and although it does not yield so much in meal, it is nevertheless esteemed by the millers. The grain is smaller than the potato oat, the straw is stiff, tall, and not easily lodged, and the grains are not so apt to be shed; the crop may be cut therefore at a later period of its ripening. The whole straw should indeed have a pale yellow colour before being cut.

(3) Sheriff oat.—This is comparatively a new oat; in some cases, with a favourable soil and under good cultivation, the yield is very high. It is earlier in point of ripening than the potato oat, the straw is of moderate length, the grain is smaller and lighter than the potato oat.

(4) Hopetoun oat.—When first introduced, this variety had a high character. It had a larger straw and a stouter than the potato oat, and was considered remarkably free from a liability to lodge; now, however, according to one authority, its degeneracy is such, especially in the latter respect, that "no variety so easily bends over and becomes straw-broken as the Hopetoun." The variety has a grain, however, of good quality, large, with a thick husk, the colour of which is darker than the potato oat, and can be readily distinguished from it "by a small reddish mark in the centre of the front of the grain." The variety is largely cultivated in the north of Scotland; the period of ripening is much the same as in potato and Sandy oats.

(5) The Angus oat.—This belongs to what is classed as the late or common oat. The characteristics of the common white

oat are large grain, thick husks, and late maturity. The Angus resembles the potato oat in quality. It is not so liable to shed when ripe. (6) The Blainslie oat is greatly cultivated in the south-east of Scotland. It has a good, well-filled grain of good quality. It is early. (7) One peculiarity of the common oat is the excellent fodder provided by the straw. The grain is well liked by the millers, as the meal yielded by it is of superior quality. (8) The Berlie oat is of two kinds, the English and the Scotch, of which, says Professor Wilson, the English "delights in good rich soils," the Scotch being "better adapted for light than for heavy." The grain of the Berlie oat is good, yields a good quality of meal; the straw is long, and the seed rarely sheds. (9) Poland oat.—Much grown in England, but inferior to the potato oat. There are two varieties, the black and the white. Intermediate between the varieties of the two species, the *Avena sativa*, or common oat, and the *Avena orientalis*, or Tartarian oat, we may class the Dun oat, which may be, as it has been looked upon, a hybrid between the two species above named. The dun oat is divided into two varieties, the Common Dun and the Winter Dun. The Common Dun is grown largely in some parts of Scotland, but always as a spring crop; it yields largely, the grain is of good quality, the meal obtained from it is good, the straw is long, but is not apt to lodge. The period of ripening is rather late. The Winter Dun is more cultivated in England and the Continent than in Scotland. In the former countries it is sown as a winter crop, being often eaten down by sheep in spring, and then allowed to grow for seed. The straw is shorter than that of the common oat.

Of the *Avena orientalis*, the two varieties are the Black Tartarian and the White Tartarian. As already stated, all the glumes are carried on one side only of the stalk. The seed of the black Tartarian oat is very long, and frequently, under bad culture, provided with a long pointed beard or awn. Particularly well suited for peaty soils, it often, when well cultivated in such, yields from 80 to 90 bushels per acre. The straw is short, the grain, if good, short and plump. The Black Tartarian is a great favourite in many districts in England, not only from the large produce it yields, but because the grain is particularly valuable for the feeding of horses. The meal produced from it is particularly good, the only fault being that, from the black colour of the husk, small black specks give a dirty look to it. The White Tartarian is also very productive; the grain is longer than the Black Tartarian, of a dull white. The straw is long and stout. Like the Black, the White Tartarian oat is highly esteemed for horse-feeding purposes. Mr Haxton, the author of the prize essay "On the Cultivation of Oats" in the 'Journal of the Royal Agricultural Society of England,' states that he "dibbled twenty-three varieties of oats in small lots after ley in a piece of good black land, and the results were very decidedly in favour of those which we have

marked 1, 2, 3, 4, 5, 7. The best crops he obtained were from the Sandy and Hopetoun among the early varieties, and from the Late Angus among the common oats. The Sandy and Late Angus gave the greatest bulk, and the straw of both stood remarkably well, although nearly 6 feet long. The latter was ten days later of being reaped than the former, and even then it was scarcely ripe. Had it been allowed to ripen fully, the difference would have been from fifteen to eighteen days later than the Sandy. It may be mentioned here, that although these experimental crops were sown with little more than 30 pecks to the acre, the crop was fully better than that sown broadcast alongside, with 4 bushels to the acre."

With reference to the varieties of oats used in Scotland, and the soils to which they are adapted, Mr Lawson, the eminent agricultural botanist, has some valuable remarks. He mentions that although there are about sixty varieties of oats met with, still considerable confusion exists with reference to them, many possessing such a close approximation to each other in external appearance, that it is difficult to separate them into classes. Of these sixty varieties, thirty, therefore, may be taken as applicable to Scotland; and of these thirty, some dozen only are in general cultivation. These dozen may be named here,—Potato, Hopetoun, Sandy, Early Angus, Late Angus, Grey Angus, Blainslie, Berlie, Dun, Friesland, Black Tartarian, Barbachlaw. Mr Lawson has classed these oats, according to the soils and situations, thus:—

First class, adapted to the best soils and sheltered situations—1, Potato oats, Hopetoun, Flemish, Early Angus, Cupar Grange.

Second class, to intermediate soils and situations—2, Sandy, Dyock, Berlie, Red Macbiehill, Blainslie, Grey Angus, Late Angus, Poland, Friesland, Lancashire Witches, Tom Finlay, Drummond, Dun, Sheriff, Cumberland Early, Cleland, Siberian, Georgian, Blue Major, Church's.

Third class, high altitudes and exposed situations—3, Kildrummie, Strathallan, Black Tartarian, Old Black, Barbachlaw, Black Murkle, Bristle-pointed.

Mr Lawson points out what he considers to be the combination of qualities necessary to be attained in oats; which qualities, he truly observes, must be ascertained or obtained by "much care, attention, and frequently repeated trials." The qualities are—(1), quantity and quality of grain; (2), quality and bulk of straw; (3), early reaping; (4), power of resistance to wind and water, &c.; (5), adaptation to the exposure and altitude of different soils; (6), freedom from disease. Knowing these qualities, the next point is to ascertain the variety best calculated to give out these. Should this variety not be in existence, it must be obtained, says Mr Lawson, by either the improvement of the old, or, by cross impregnation, to generate a new variety.

Of the principal points connected with the soil and climate adapted for the oat crop, the writer already named (Mr Haxton) has given, perhaps, the most suggestive if not the most exhaustive *résumé*; we shall therefore do well if we present to our readers a condensation of this. Scotland is selected—and selected with precise judgment—as the “type of an oat-growing country:” with a cool climate, the mean maximum in the hottest month of the year, and in the warmest districts, not exceeding 68°, the soil is peculiarly adapted for the crop. The climatic or weather influences which affect the oat crop are different from those which affect the barley and the wheat; so much is this the case that we have no difficulty in knowing, if from no other sources of information than that of the market prices, that where the first price is got for the barley and the wheat of any district, that the oats of that district will not be good; and the converse of this holds equally good. For instance, the wheat and barley grown under proper conditions in districts south of the Humber, are as superior to those grown to the north of the Tweed, as the oats grown to the north of the Tweed are as superior to those grown to the south of the Humber. Nor is this marked difference traceable to any difference very marked in character between the geological formations of the soils; doubtless, these differences do exist, but in no way so marked as to account for the differences we have named as existing between the quality of the crops. The opinion is thus likely to be a true one, that the difference arises more from a difference in climate than in geological causes. This influence or opinion is corroborated by the fact that, as we proceed northwards and westwards in England, we come to districts adapted for oat-growing. This view receives further corroboration in taking into account the “extraordinary results that have been produced by certain climatic aberrations which have occurred within the period of the present century.” Thus in the very dry summer of 1826, the oat, especially in the drier districts, was an extremely light one, while, on the other hand, the wheat crop was an extremely good one, bearing a marked resemblance to the superior quality of south-of-England-grown wheats in moderately warm weather. In other countries, both in Europe and America, although lying within the same parallels of latitude as Scotland and the north of England, the oat crop is a failure, or at least gives an inferior yield, and this, apparently, owing to the high range of summer-temperature prevailing. The conclusion thus arrived at is, that the northern parts of this kingdom, and nearly the whole of Ireland, derive their oat-growing capabilities, in the first place, to their insular position; and in the second, to the mountainous character of the land—a combination insuring a “large amount of aqueous vapour in the atmosphere, and its deposition in the ground in the form of refreshing rains, mists, and

dews." But while Scotland retains as yet her pre-eminence as an oat-producing country, just as she has, by improved modes of cultivation, enabled her farmers to raise now better crops of wheat and of barley than were produced half a century ago, so may we expect that by a like introduction of improved practices into the south of England, farmers there may succeed in raising good crops of oats—that grain which will always possess a high value in the farm, if not as food for men, as food for horses. But although it is apparently true that good crops of oats depend more upon a proper condition of climate than upon the qualities of the soil—for good farming produces good crops on all soils—it is not by this meant to be assumed that the quality or nature of the soil is a matter of little or no importance. Not so; for assuredly one soil is better adapted to produce a good quality than another, and there are also certain districts in which oats of one kind succeed well, where oats of another kind will not succeed at all. We proceed, therefore, to take up the subject of the soils best adapted for the growth of the oat.

For the earlier varieties of the *Avena sativa* class of oats, such as the Sandy, the Potato, the Hopetoun, &c., the best soils are those derived from the alluvial deposits of the trap and new red sandstone formations, which form the lower parts of valleys, and the more level districts in which these two classes of rocks abound. So that, as a rule generally applicable, it may be stated that "wherever a soil has been formed by the alluvium of rocks or strata not characterised by the presence of too great an amount of aluminous or clayey matter, there we have a soil which, if drained and in proper condition, will produce excellent crops of the finer varieties of oats." Such is the soil of the county of East Lothian, and, to a certain extent, also that of the southern part of the county of Fife, the soil of this being composed of trap debris and red and yellow sandstone deposits. All soils derived from trap rock, greenstone, basalt, and porphyry, as is the soil of the northern part of the county of Fife, are, to a greater or less degree, fitted for growing good crops of oats, the lower parts of the districts where those rocks abound affording a rich alluvium, capable of growing crops "with little trouble or expense;" and even in the higher and more thinly covered parts, good crops may be obtained if sheep-folded, and kept two years under grass.

Good crops of oats are produced on soils derived from the mountain-limestones, but they demand more rich manuring than the freer trap and loam soils.

On the clay wheat-soils of the celebrated carse of Gowrie and of Stirling, the cultivation of oats is not otherwise generally than precarious, much depending upon the character of the seeding-time. When the soil has been properly mellowed by the winter's frosts, if the seedtime is dry, and the period of growth of the crop

not too wet, the carse lands produce very heavy crops; but still, unless all the conditions are favourable, the crop is, as we have stated above, a precarious one, and does not assume the important position in the rotation which it does in other districts. In clay soils, oats are found to succeed best after a crop of red clover; the stronger the clover is, the better the oats. On the outer edges of the clay basins being reached, we come to a lighter class of soil, which produce good crops of oats, so that the crop may, in such situations, be made to form part of the rotation.

The soils of England similar in character to those of the carses of Gowrie and Stirling, above described, are those met with in the wealds of Kent, Surrey, and of Sussex, the gault of Cambridge and Huntingdon, and all those varieties of clay known as the London or plastic clays, the dread of many a farmer. Unfitted for the production of barley, it is very desirable to have oats grown upon these; but this is difficult to be done in some of them. If attempted, it is at the best a precarious and uncertain crop, although in some of the better class, oats could be grown if properly drained. Even the most tenacious of these bricky clays could be rendered more fitted for the oat crop, by properly draining them, liming, and carefully working. As already stated, red clover should precede the crop, the land being ploughed early in winter or late in autumn, so that the atmospheric influences may be allowed to operate as long as possible, in order to mellow and pulverise the soil.

What are sometimes called "vegetable mould soils"—that is, deep alluvial soils rich in vegetable matter—are "peculiarly adapted to the production of oats;" that is, of course, when passed under a proper *régime* of culture. Indeed, where the climate is peculiarly cold or wet, oats is the only cereal crop that can be successfully cultivated on such soils. Soils of this character possess the property of capillary attraction in a high degree, so that where thoroughly drained, and when the season is warm, the moisture they retain is quite sufficient to supply the crop during the period of dry weather. On the other hand, they can stand long-continued rains better than clay soils, which get under such circumstances what is called "soured," and if dry weather succeeds, cracked and baked. The fens of England have long been famous for their productive crops of oats, and are cited by Mr Haxton as an evidence that a "certain degree of depth and dampness in the soil," even in districts not climatically suited to the crop, compensates for their higher temperature, and for the lack of atmospheric moisture. There can be no doubt that this point of climatic influence upon the productiveness of the oat crop is of very great importance, and should not be overlooked in treating of the economy of the plant. Having thus glanced at the peculiarities of the best and at the moderately good soils for the oat crop, let us do the same office for those not so adapted.

As the soil obtained from the alluvial deposit of the trap and new red sandstones may be looked upon as the best and most fertile for the oat crop, so may the soil composed of "loose calcareous matter" be looked upon as the most sterile. Of this class are the upper chalks of England, including sands and gravels. Mr Haxton, in treating of this class of soils, draws attention to the fact, that it has been frequently remarked that in the case of light soils which have been long under cultivation, a *second* application of lime, if not positively injurious, is, at all events, not beneficial to the oat crop; indeed, he states that an overdose of caustic lime or of purely calcareous chalks is frequently productive of the worst results. He names instances where light gravelly soils were rendered incapable of growing oats for a long time through having been top-dressed with a rich calcareous shell marl found in beds underlying peat. On all light soils composed principally of gravel, sand, loose brown earth, or decomposed peat long under cultivation, lime should be sparingly used, as an overdose is always fatal to the success of the oat crop. The same effects of an overdose of lime are not observable, it is right to state, in deep alluvial soils, whether these be made up of clay, loam, or of black mould. Loose, mossy, or gravelly soils, which have been *long under cultivation*, are, according to the experience of this authority, always the worse of liming; and the point is all the more worthy of observation, as on the first of these—namely, mossy or peaty soils—oats, as we have before stated, is the only cereal crop which can be cultivated. Of course, in the primary treatment of peaty or mossy soils, liming is essential, in order to act upon the inert vegetable matter, and neutralise or bring into good action the acids with which it abounds. But as soon as the soil is fairly formed by liming and by proper culture, a second liming will be found more injurious than beneficial; bone-manuring will, therefore, be better than the application of lime or of shell marl. Clay marl, rendering as it does the light soil more cohesive, and more absorbant and retentive of moisture, will be beneficial in such cases. Of all the profitless and annoying soils to take in hand for the cultivation of the oat crop, that class known generally as moor-band is the worst; in these soils, indeed, consisting of mossy land overlying a subsoil of mixed clay, sand, and oxide of iron, oats, as a rule, almost refuse to grow—or at least refuse to grow well. The moor-band, forming a hard, impenetrable crust below the upper surface, completely prevents all capillary action from below, so that in dry weather there is no moisture ascending to the roots of the oat crop above, and the consequence is that at a certain stage—generally as the shot ear or shot beard is being formed—the plant begins to droop, to turn yellow, and finally and completely to blast all hopes of a coming crop. The result is all the more depressing, inasmuch as generally

the crop at its first start has all the appearance of a peculiarly healthy and promising one. Even when drained and fairly well cultivated, moor-band soils never yield a successful crop of oats. The following is a list of the soils adapted for oats, arranged into groups, commencing with the highest and most favourable sorts:—

First class—(1), rich, friable, reddish-coloured loams, derived either from alluvial in their origin, or derived from the new or old red sandstones or basalt, or from greenstone; (2), rich, black loams at the base of trap hills; (3), drained and clayed farm lands. *Second class*—(1), limed and furrow-drained clay; (2), medium, trap, and whinstone soils; (3), light, loamy land; (4), moss or peaty land reclaimed. The soils of both these classes are, with the exception of the last (4), of the second class, well adapted for wheat as well as oat crop, when they are situated in a dry and a warm climate. The second soil of the second class, as also the third, require to be folded by sheep or consolidated by roller to improve their consistency. On all soft soils, as reclaimed peat, soft loam, or black earth, the oat crop assumes of necessity a prominent position; as barley is practically excluded from them, through the tendency it has to produce straw rather than grain. And although wheat can be and is grown on black earth or soft loam soils, still this is only the case where the climate is dry and warm, and where the intervals between its appearance on the same soil are longer than is usual under ordinary rotations. Oats, therefore, in such soils become *the* grain crop to which all the aims of the farmer should be turned. The *third class* of soils is made up of (1) thin gravel soil left by the infiltration of water; (2), poor whinstone soil situated on the higher parts of greenstone trap-hills; (3), loose sandy soil; (4), loose calcareous soil; and (5), cold poor clay soil. It is only by putting this class of soils under the highest farming, or by keeping them under grass for a long period, that they can be made oat-producing. Even where the climate is cool and moist it is a difficult matter, from such soils, to raise good crops of oats; it is, therefore, almost useless to try to do so where they are situated in dry and warm districts. The easiest and the most economical way to bring such soils, where the climate is suitable, into oat cultivation is to pasture them two or three years in every rotation, and where turnips can be grown, to bone-manure them, and eat them off the land by sheep. On the subject of oat-cropping of such lands, Mr Bennett states that upon strong, poor, sterile, clay land, no crop will pay better than the oat, when taken after the summer fallow. In Bedfordshire, on land of this class, the following is the plan of cropping, which Mr Bennett adds may be carried on with advantage *ad infinitum*. One-eighth of the fallow to be a dead or summer fallow; the other one-eighth to be sown with winter tares, eaten off by sheep, and fallowed. In the suc-

ceeding year, the eighth which was bare or dead fallow is to be cropped with oats, and seeded down; the other eighth which bore tares to be cropped with barley and not seeded; the crop next taken off this to be beans, the other being seeded; at Michaelmas the other two-eighths or one-fourth to be wheat. As seeds (grass) never flourish after tares, the eighth that was under summer fallow should only be seeded.

As regards the kind of soil best adopted for the different varieties of oats we have already named, the following "notes" may be useful:—For potato oats the best soil is black land, or reddish coloured loam of a consistent and firm texture, but not clayey. Sharp trap whinstone soils, and the better class of granite soils, are also well adapted for the potato oats. As on clay land the roots of the plants of the potato oats are apt to become sedge-rooted when there is much rain in spring or early summer, this class of soil is not fitted for this variety. Sandy oats grow better in clay land than the potato; they are most valuable on soft moss soil. The Hopetoun oat grows well on light soils, but not on high and exposed parts. For peaty or marshy soils the black Tartarian oat is well adapted—that is, where they are well cultivated and clayed or gravelled. It is also a good variety for high-lying late districts, but is not suitable for dry trap soils. The Dun oat grows best on clayey or cold soils, becoming rapidly deteriorated in light dry soils.

The *place of oats in the rotation* of a farm is usually after grass which has either been cut for hay or pastured, although modification depends upon local and other circumstances. In the five or six courses of husbandry, oats come, as above stated, after the seeds or grass. The crop may, however, succeed beans or turnips; in some districts in England it is taken after the wheat; throughout Scotland the rule is pretty universal that the oat should follow the grass crop. The modes of managing the land after grass are fully detailed in the paper to which we have alluded, and we shall therefore give a *résumé* of what is there stated in connection with it. If the grass has been down only for one year, and been depastured by *sheep*, it is looked upon as valuable for the oat crop as if it had been grazed for two years by cattle, and this on account of the equal distribution of the manure over the surface given by the sheep. While excellent crops of oats can be got off first class soils after rye-grass or clover cut for seed, summer soiling, or for hay, on second class soils, to have them of the necessary fertility, it is necessary to pasture them with sheep for one year or graze them with cattle for two, before breaking up the grass land for the oats. Where the grass is, however, cut for hay the first year, the after-grass should be depastured and sheep folded on it the following winter, these being fed with turnips, cakes, and grain. If this is done, giving one acre of turnips to three

acres of the lea, the manuring the land will receive in this process will be as good as that obtained by depasturing the grass with sheep for one or with cattle for two years. When the soil is inferior the grass should be kept down, as we have already stated, at least two years ; but all the better crops of oats and succeeding crops will be obtained if three years be the period.

Although climate has a remarkable influence on the oat crop, irrespective of the condition of the soil, still the preparation of the land for the crop is a matter of great importance. Generally it may be stated that, resembling in its habits of growth the wheat more than the barley plant, a good deep well-stirred soil is necessary, the roots having more of the descending vertical development of the wheat than the lateral development of the barley plant. Further, although loving a moist climate and soil, a thoroughly wet one is prejudicial in a high degree to the oat; well-drained, in addition to deeply-stirred soil, is therefore essential, if indeed the one can be obtained without the other. In Scotland, the ploughing of lea for the oat crop is looked upon as one of the nicest operations which the ploughman is called upon to perform, and is carried out with the most scrupulous care, the pride of the ploughman being bound up in its beautiful execution. The lea ploughing is not usually begun till near the New Year, but it is in February, the frosts then being not so severe, that the principal labour is performed in this department. The older and tougher lea land should be ploughed up the first, as it requires to be longer acted upon by the frost and atmospheric influences of the winter. Clover being the freest, may be ploughed up last. Mr Haxton recommends the press-roller to be used in ploughing lea for oats, as by it the grassy part of the furrow-slice is completely pressed down and buried, a seed-bed being at the same time formed by the tapered or conical periphery of the wheel. The operation of press-wheel rolling is also thought to be beneficial in preventing the ravages of the wire-worm, which, as we shall hereafter see, does great injury to the oat crop. It is necessary, however, to state that the action of the press-wheel roller is not so beneficial, if indeed it should be used at all, on damp or clayey soils ; it certainly gives the best results on light soils. In ploughing lea land it is absolutely essential to note particularly the condition of the land as regards its moisture. Lea should never be ploughed in so wet a condition as to leave a glazed surface on the furrow-slice. This may be done, as it is often done, early in the season, when succeeding frosts are likely to follow, which will mellow down the glazed furrow-slices ; but if done late, the chances are that the glazed furrow-slice becomes hardened, and will not yield kindly to the pulverising influences of the harrow. There is no point more frequently overlooked by careless farmers than this, namely, the condition in which the land is when being ploughed. In prepar-

ing land for oats after a root or fallow crop, it is usual, at all events it is deemed advisable, to plough land as soon as the roots are taken off the land, giving a second ploughing in the spring, should that be necessary. This second ploughing may, however, be avoided by ploughing deep enough at the first, so that a sufficient depth of mellowed soil may be obtained in spring time.

On the mechanical condition of the soil necessary for the oat crop, Professor Tanner has given some excellent remarks in a paper in the 'Journal of the Royal Agricultural Society,' of which the following is a brief *résumé*:—"Oat plants possess greater vital or natural energy than barley, resembling, indeed, in this respect, the wheat plants. This influences the preparation which it is desirable to give to the soil upon which the crop is to be grown. Oats are usually taken either after roots, or upon a fresh broken clover ley or turf. When taken after roots, the land is usually ploughed once, and allowed to remain sufficiently long exposed to the atmospheric influences to be mellowed before the seed is sown. When the crop is taken after clover ley or fresh broken up turf, the ploughing should be so much the earlier performed, as the turf is hard and tough, so that as long time as possible will be given to the atmospheric influences to mellow and reduce the clods. If the turf is old, the ploughing should therefore be done before December at the latest; two or three year-old clover ley may be left unploughed till a later date than this. It is admitted, however, that whether in the case of old turf or two or three year-old clover ley, an early ploughing is better than a late, for the longer the period within which the clods are exposed to the atmosphere, the more mellow, and therefore the better fitted for the crop, the soil is."

In order to get the grass of turf land well turned in, it is advisable to use the skim coulter; and, in addition to the use of this appliance to the plough, the land press-roll or wheel may be used with advantage, the object being, not only to bury the grass completely, but to give a solid furrow. Left thus in early winter, the land exposed to the atmosphere and frosts gets into the mellow friable condition best suited to the crop—the seed-bed, in fact, possessing all the necessary characteristics, "well charged with vegetable matter, firm beneath, yet easy of penetration for the rooting of the plant, with a surface light and free in its character for the germination of the seed. This firmness of land for the root must be distinguished from the hardness with which wheat will contend after it has once made a fair growth." Professor Tanner makes pointed reference to the difference between the liking, so to speak, wheat and the oat plants have for firmness in the soil, and notes that he has known wheat land so "fearfully trodden during the winter (by no means an unusual circumstance in hunting districts, when a large number are in at the death) that all vestige of

the wheat plant has been destroyed ; and yet at the following harvest the wheat crop on such portions has been very superior." This condition of soil the oat could not bear up against, for although it requires a firm, it cannot do with a hard soil. In the north of England, where the turf of a clover ley often becomes too rank for the wheat, the oat comes in excellently as a substitute ; cases indeed are not often met with there in which either wheat or barley can displace the oat crop in newly ploughed-up old and rich turf. The oat crop is remarkable for penetrating and breaking up turf ; indeed there is no corn crop so valuable for this, the turf presenting precisely that condition of soil required for the habits of the plant, and where the seed requires a light covering, the soil is exposed to the action of frost, and lightly tilled. To get the condition of soil necessary, the land should be ploughed "moderately moist," but it should be thoroughly dry when broken down for the sowing of the seed.

If oats are sown upon turf, the seed should be sown earlier than if they follow roots on a bare fallow. To early sowing this objection may be made, that exposing the early plants to frost, the blades may become blueish, as if they were injured ; but to this may be answered, that even if this does result, the plants rapidly recover. Some have the notion that oat plants do not stand the frost well. This, however, is a mistake. A very remarkable experiment was made many years ago in sowing oats at Christmas ; the plants not only stood the frost which followed remarkably well, but the produce was very much larger than that of a field sown at the usual period. We ourselves have had oats which braided in the autumn before the frosts had set in, and which stood its attacks, when it set in fiercely, remarkably well. Early sowing is now rapidly on the increase, and one reason indeed for the almost general use of broadcasting in place of drilling, is the rapidity with which the sowing is gone through, so that early sowing is obtained. Moreover, the land may be in fair enough condition for harrowing after broadcasting, yet not dry and mellow enough for drilling. Where time will permit, especially in the case of foul grass land, the drill should be used, as the use of this machine will enable the weeds to be destroyed—at least to such an extent as not to injure the crop, weeds being very noxious to it.

The seed being got in either by broadcasting or drilling, the harrowing should be well done, so as to cover the seed completely. Some use the roller to smooth off and slightly compress the land after the harrowing ; but, as a general rule, it will be better to leave the surface rough after the harrow. The roughness thus given to the surface has many advantages attendant upon it—the inequalities protect the plants, affording, so to speak, little sheltered valleys between them, in which the early plants can grow, not attacked by cold frosty winds ; further, that by the time the oats

are ready for the roller, the clods will be well mellowed, and will be easily reduced by the action of the roller to a fine earth, which will thus aid the progress of the plants by adding fresh soil to them. Upon blowing sands this roughness of the soil is essential, as it is often the only means left for protecting the crop. Professor Tanner states that he has known the greater portion of an oat crop fairly blown off the land, through the surface having been smoothed off by the roller after harrowing in the seed. In such light soils, deep sowing—two inches—is quite necessary.

We now come to the choice of seed, and much of what we have said on this point in connection with the wheat and the barley crop will refer to the oat crop; certainly not less pointedly so far as regards this—that the quality of the seed be the best which can be got. We are no believer in the notion that poor seed grain gives good harvest grain; the very contrary we believe in. Further, the seed should be free from injury, although, to be sure, this recommendation is of necessity involved in that already given; for an injured grain cannot possibly be said to be of good, certainly not of the best, quality. Lastly, let the seed be true to its variety, for if you wish a certain variety for a certain purpose, or as being adapted for a certain soil, if you do not obtain this variety true, disappointment will result. We have drawn attention in a previous paper to the mixture of different kinds of seeds for wheat. However doubtful this practice may be in connection with the wheat crop, as doubtful by some authorities it is deemed to be, there seems little doubt of this, that a mixture of different varieties of oats is productive of considerable advantage. The following on the mixture of oat-seeds is from the pen of the late and lamented Mr Finnie of Swanston:—"The practice of mixing two or more varieties of seed has become of late years very common in Scotland. The object for doing so is to obtain a heavier and more prolific crop, by taking advantage of the particular habit of growth of different varieties, so that the excellencies of the one may compensate for the deficiencies of the other. Thus it is common to sow a mixture of Hopetoun and Sandy oats, because the former is weak-strawed, stands thin on the ground, but very prolific; while the latter is strong-strawed, grows thickly, but is less productive; consequently, a mixture of this kind generally yields a better crop than when each variety is sown separately. Of course it is necessary in such cases to select such varieties of oats for mixing as possess about the same degree of earliness, in order that the whole may come to maturity at the same time." The following results of trials on the same extent of land, made by Mr Finnie, show the benefit obtained by a mixture. The following varieties, used alone, gave the results as stated:—Potato oat, 74 bushels; Hopetoun, 65; early Angus, 77; Kildrummy, 77; Dun, 76; Blainslie, 70; grey Angus, 63; Sandy (changed seed), 61; Sandy

(home growth), 50. Whereas the following mixtures gave these results :—Hopetoun (5 parts), Kildrummy (1), produce, 85 ; Hopetoun and Sandy, 80 bushels ; Hopetoun and early Angus, 76 ; potato and early Angus, 66 ; and potato and Sandy, 66 bushels. From these results Mr Finnie drew the following conclusions :—“ First, it appears that potato oats sown alone produced 8 bushels *more* than when sown with either early Angus or Sandy ; secondly, that Hopetoun oats produced 20 bushels less when sown alone than when mixed with Kildrummy, 15 bushels more than when sown with Sandy, and 11 bushels more when mixed with early Angus. If there was no difference of soil or treatment in the above comparison, it appears that the average increase of produce from simply sowing a mixture of oats amounts, in the cases selected, to 13 bushels, from a space of ground which took 6 bushels to strew it.” These experiments show enough to induce others, probably on a more extended scale, to be made. While the practical man should never forget that such experiments are not absolutely correct, as indicative of similar results under different circumstances of soil, locality, and climate, all of which exercise a most important and modifying influence, nevertheless they are valuable, as showing relatively the influence of certain modes of treatment. At the same time, it does not always follow that experiments made in one place indicate what the results, even relatively, may be of exactly similar experiments made in another and a different place. Thus it may happen, as indeed in practice it often does happen, that the result of precisely similar experiments in different places may be quite contradictory, the indications afforded by them in one being totally opposed to those afforded by them in another place. All these, and other considerations more or less important which might be named here, very forcibly bring again to our mind the point on which in last article we insisted very strongly—namely, the necessity that exists for our leading Agricultural Societies to come forward to institute a set of experiments which will set at rest, so far as they can be set at rest, the various questions now more or less disputed, and which influence to a greater or less degree the future of agriculture. We say, so far as such questions *can* be set at rest, the probability being that in some, if not in many cases, we shall find that distinct and decided results, applicable to all diversities of practice, will never be obtained. But, as has been well remarked in scientific discussions, the answer “ No,” is just as valuable to us as the answer “ Yes.” There are, therefore, some departments of culture in which we are at present asking the question, Will this direction lead to practically useful results ? and which at present we must continue asking, seeing no one comes forward to say “ Yes ” or “ No ” ; and it is clear that if progress in that direction can lead to no good, it is exceedingly useful for us to know that, inasmuch as we shall have at least the

negative advantage of knowing, that all attempts to go in that direction will be but lost time. It so happens that there are, in the cultural departments of agriculture, many questions to which it is advisable that the answer "Yes," or the answer "No," should be given with all due speed. Isolated efforts to answer them must of necessity, in a science with principles so unfixed and so liable to modification from ever-changing circumstances as agriculture is, be unsatisfactory and vague to a greater or less degree. Why should these inquiries, involving as they necessarily do the expenditure of much time and labour, be left to be pushed forward by private individuals? In view, indeed, of the persistent efforts made by our leading societies in one or two directions—oftener in one than in two, unfortunately—we are very apt to ask, What is the object of our societies' existence, or is it indeed *one* object only. How is it that so much attention is paid to our stock, while absolutely none is given to the raising of the food which supports them? All the more urgently need the question be asked now, at a time like the present, when the question is so often asked, "How are we to find food for our stock?"—often asked indeed, not often satisfactorily answered. The subject, then, of action on the part of our societies to take up the settlement of points connected with crop cultivation is of great importance—second, indeed, we venture to maintain, to none, and the advocacy of which is in nowise out of place in a series of papers the object of which is to gather up from a wide variety of sources all, or nearly all, that can be said on the subject. Nor is it the least convincing proof, if proof indeed is needed, of the amazing apathy of our leading agricultural societies in some of the most important departments of cultural economy, that in these papers we have little information to give of much value derived from the direct and immediate action of these societies. True, it may be said that these societies give—liberally it cannot be said they give—prizes for essays on these very points. This, we take it, does not convey a correct notion of how the matter stands. These essays are often—nay, we may say almost always—very good; but if based upon practical experience, that experience, being that of individuals, must necessarily be limited; and if experiments are detailed, these also must be limited; and we have already insisted upon this, that the points about which so much uncertainty exists can only be decided, if indeed they are at all capable of decision, by an extended series of experiments under different circumstances of soil, climate, and locality. Can this extended series ever be undertaken? will it ever be undertaken by individual enterprise? There is but one answer, and one only, to this question. What that is, need not to be here at least explicitly stated. We make no apology whatever for here introducing these remarks; none is needed. No place can possibly be more appro-

priate for them than this ; no time more opportune than the present remarkable season.

There are some points still connected with the seed and sowing of oats to which we must refer here. As regards the quantity of seed to be employed, we find the same diversity of opinion existing which we find to exist amongst practical men on the wheat and barley crop, some insisting upon thick, some upon thin sowing. It is worthy of note here, however, that the opinion of the most advanced authorities is the same as in relation to the wheat and barley crop—namely, that thick sowing is not so good as thin sowing. In Scotland, from $3\frac{1}{2}$ to 6 bushels per acre is a usual quantity ; in England from 2 to 5. As a rule, thick sowing is carried out in Scotland on the ground that it is required from the habit of the plant not to tiller out so well as the wheat or the barley crop. Mr Haxton looks upon this thick-sowing system as a decided error, and states that “the moisture of the climate has greatly favoured the practice, and counteracted its bad effects by keeping these thickly-sown crops in a healthy growing state ; but in a drier climate the same error would occasion much more mischief, inasmuch as the thicker a crop is sown, the more does it ultimately suffer from long-continued drought. Three bushels of early and small-seeded oats are quite sufficient to sow one imperial acre with, and 4 bushels of the coarser-grained sorts.” Mr Bowie has instituted some experiments which tend to show the advantage of thin sowing ; these experiments were carried out on a soil “rather poor than in good condition.” The results are therefore all the more suggestive, inasmuch as thick seeding is generally considered applicable to such soils, thin seeding being considered only applicable to rich soils. The following is a tabular statement of results :—

Quantity of Seed per Acre.	Yield per Acre.	Weight per Bushel.	Weight of Straw per Acre.
Bushels.	Bushels.	Lbs.	Cwts.
6	53 $\frac{1}{2}$	42 $\frac{1}{2}$	35 $\frac{1}{2}$
5	58 $\frac{1}{2}$	43	38 $\frac{1}{2}$
4	66 $\frac{1}{2}$	43 $\frac{1}{2}$	45 $\frac{1}{2}$
3	66 $\frac{1}{2}$	42 $\frac{1}{2}$	47 $\frac{1}{2}$

On this as on other points it is not possible to lay down a rule applicable to all districts and localities ; much must ever be decided by the peculiar circumstances attendant upon each kind of practice. At the same time, it is worthy of note that the growing opinion is that in all cereals, oats as well as barley or wheat, thin sowing is better than thick sowing ; what the minimum and what the maximum, will have to be decided according to circumstances. (On this point, see a few remarks in No. V. of this series of papers.)

The time for putting the seed in is a point of practice as much dis-

puted nearly as to the quantity of seed to be put in. Like the latter, the former point must be greatly dependent upon the locality and circumstances of soil. Just as the growing opinion is in favour of thin sowing, so is it in favour of early sowing. At the same time it is to be observed that the land must be in good condition—that is, it must be sufficiently dry to work to a nice tilth. This circumstance will generally decide the question as to the period of sowing; for whenever the land is in “good heart,” as the expressive phrase goes, that is the time to sow; indeed, it appears that it cannot be too early in the year. As one eminently practical authority remarks on this very point, “The time for sowing is to be fixed whenever the land will work, whether it be in January, February, or the early part of March.” The same authority says, “Never lose one opportunity of sowing when the land is sufficiently dry to work after the commencement of the new year.” Another authority says, “The oat seed time in Scotland extends from the 10th of March to the 10th of April, according to circumstances. In south England oats should be sown early in February, and even sooner if the variety to be cultivated belong to the later sorts. *By early sowing* the young plants are up and covering the ground before the hot season arrives, and the natural moisture is thus economised and preserved from evaporation.”

The sowing of the oat crop next demands our attention. Generally the broadcast system is adopted, although the use of the drill is gradually extending from the south to the north. In Scotland the oats are sown broadcast on the winter furrow, the seed being covered in by two, three, and sometimes four harrows coupled together. The number of harrows used, however, depends upon the quality of the soil; the lighter the soil the greater the number. The first stroke of the harrows is given in the direction of the furrows, the harrows following the sower, who can put in, in level ground, seed for 25 acres per day; in hilly, 20. The second stroke of the harrows is either across the ridges or obliquely to them. The amount of harrowing depends, however, very much indeed upon the nature of the soil.

The *diseases* of the oat are not so numerous as those of the wheat crop—at least this may be said of diseases of a fungoid character, the only one of this class which is also so destructive to the wheat being the “smut,” *Uredo segetum*. The oat crop is, however, liable to the attacks of insects, of which the worst is the “wire-worm.” A notice of the principal peculiarities of the smut will be found in No. IV. of the present series of papers; we shall therefore here confine our remarks to the insect depredators of the crop, taking up the wire-worm first. While certain crops have what may be called their own peculiar insect scourge which affects them alone, or at least plants of the same natural order, as the turnip-fly to the cruciferal and the Hessian fly to

the cereal plants, the true wire-worm is such a universal feeder that no plant can be said to be safe from its ravages. What, therefore, we have in the present division of our papers to say about it, although referring specially to the oat crop, will also have a practical bearing upon the wheat crop, which we have already discussed.

In practice, it is the habit of farmers to class all grubs and worms under the designation of wire-worms. This has, of course, given an appearance of much greater importance to the ravages of the wire-worm, so called, than is properly due to it ; but, as that able entomologist, Mr Curtis, observes, the true wire-worms "have enough to answer for on their account ; and the great ignorance," therefore, "that has existed regarding them," gives a high degree of practical utility to all remarks bearing upon *their* characteristics, and on the best mode of meeting their ravages.

The wire-worm commits frequently great ravages on the oat crop. This is known as the *Elatér Lineatus*, otherwise the *Agriotes Lineatus*, also *Cataphægus Lineatus*. The wire-worm is the larvæ of a very numerous species of beetle of the genus *Elatér*. As many as sixty are known in this country, and are all eminently destructive of vegetable life. These larvæ feed upon the roots and the lower part of the stems of the cereals and grasses, and are particularly destructive to the oat crop, arising from a very general practice of taking this crop immediately after the breaking-up of grass-land, in the soil of which the eggs are abundant. The body of the wire-worm is long and slender, about one inch in length, cylindrical, made up of a series of twelve rings or segments, the three segments nearest the head bearing three legs on each side : the body is smooth generally, although provided with a few hairs scattered here and there ; the colour is yellowish, with brownish head. The length of the pupa, or chrysalis—the third stage of insect life—is about one-fourth that of the larva ; its colour is whitish, and is made up of ten rings and segments, the last of which bears at the abdomen two short projecting spines ; two black spots are placed over the eyes. The wire-worm remains in its larva or grub condition for several years. The "imago" or perfect insect, the last stage of insect life, is a beetle, known popularly as one of the snapping-beetles or bugs. Its length is about one third of an inch. The colour of the body is brown, the legs a dark yellow. The name of the genus *Elatér* is given to it on account of the peculiar power possessed by the beetles of leaping up when placed by any circumstance on their backs—a characteristic notable enough, as those who are acquainted with the habits of insects know. Many will have doubtless noticed beetles lying on their backs making painful but useless efforts to recover their position ; these do not belong to the genus *Elatér*. The wire-worm is often found in such marvellous abundance,

eating down the crops as fast as they come up, that the only remedy thoroughly effective is starving them out, by keeping the land free from vegetation, ploughing and stirring it frequently, and keeping it as clean as possible. The birds which prey upon insects are the best friends of the farmers; in many cases not the less are they so in their endeavours to get rid of the wire-worm, vast numbers of which are devoured by them. The wire-worms are also preyed upon by an ichneumonous parasite, and by several insects. The small black shining beetle, the *Steropus madidus*, also devours them largely. In breaking up grass-land a good preventive of the ravages of the wire-worm, according to that eminent agricultural entomologist Curtis, is to shallow breast-plough up to a depth of 2 inches, or by paring and burning the surface before the ploughing is done. All sorts of remedies have been suggested for the destruction of the wire-worm, as steeping the seed in wine, and then drying it with sulphur, liquid ammonia; and also by the growth of white mustard, a plant which seems to be particularly obnoxious to the larvæ, but of which it has been said—in view of the fact that there is perhaps no more noxious weed than this plant where land is neglected—that the remedy may be worse than the disease. Salt, to the extent of 10 bushels the acre, and lime 100 bushels to the acre, have both been tried, but in some cases with marked results of anything but a gratifying character. In America a plan, which has been very successful, is taking a crop of buckwheat after the grass has been broken up; late ploughing and frequent, as often as possible in the autumn; then sowing peas in the spring, then frequent ploughing next autumn. This plan followed, no crop succeeding has been attacked.

Curtis, in his well-known paper in the 'Journal of the Royal Agricultural Society,' has completely exhausted all that can be said on the habits, characteristics, and modes generally adopted to prevent the ravages of this insect-scurge of our farm crops. In the sixth paper of this valuable series (vol. 5th of the 'Journal,' 1844), the reader anxious to go deeply into the subject will find a vast amount of matter bearing upon it. It will answer the purpose we have in view in the preparation of these "Notes" if we give here a rapid *résumé* of the principal points there touched upon. Of the beetles belonging to the genus *Elatér*, or leaping beetles, which are the parents of the true wire-worm, there are four species which most commonly attack the cereal crops. These we very briefly describe, referring to the paper above alluded to for a detailed description of them. (1.) The *Elatér sputator*. This is the smallest of these four common species; its colour is variable, and is met with in our corn-fields in the spring. (2.) *Elatér obscurus*. This is larger than the last species, and, like it, is met with in the spring. (3.) *Elatér Lineatus*. Of this Mr Curtis says

that it is "supposed by some to be a variety of the foregoing species. It is now by far the most abundant, and is found in spring and summer." (4.) *Elater ruficandis*. This is the largest of the four common species, and is found in the spring infesting nettles abundantly. It is not yet determined, or, if determined, not, at all events, widely known, whether the eggs are laid by the female beetle in the earth, or in the base of the cereal plants. When the wire-worms are first hatched they are very small, but attain, when fully grown, a length of from three-quarters of an inch to an inch. Their growth is slow. One remarkable peculiarity possessed by the wire-worm is the long period in which it remains in the larva condition—namely, five years. Thrice during this period they cast off, so to speak, their outer skins; this at intervals probably corresponding with their increase in size. Following upon this curiously interesting operation, the wire-worms are white in colour, and have under skins. Recovering, however, their normal condition of tough smooth skin, they move along the surface, and dig or burrow into the bosom of the soil with great facility. Having gained the last stage of its larva or worm condition, it descends deeply into the soil, and, forming a bare-walled elliptical-shaped cell there, it assumes the pupa or chrysalis form, this taking place somewhere about the end of July or the beginning of August, and retaining this pupa condition some three or four weeks—probably, however, for the whole of the winter in some cases when buried deeply in the soil. Early in August, however, is the period ascertained by observation when the insects work their way through the soil, and commence their life on its surface as the perfect beetles. These "*beetles run* with their heads down, and drop when approached: they also *fly well*, and are *perfectly harmless*, feeding only on flowers." Of all the cereal crops, the oat crop suffers most severely from the attacks of the wire-worm; so much so, that "sometimes it compels the discouraged farmer to lay down valuable land as pasture to a very great disadvantage." The barley crop suffers from the attacks of the wire-worm, these being indicated by the change of colour which in spring-time the crop undergoes from a healthy green to a sickly yellow. The wheat plant also suffers very much from the attacks of the wire-worm, which are said to continue throughout the whole of the winter; but Mr Curtis takes leave to doubt whether this is the case; "for during severe frosts," he says, "they descend into the soil, like the larvæ of the cockchafer, retiring deeper and deeper as the cold increases; but early in the year, depending greatly on the temperature, they make ample amends for their fast, if such be the case, by diminishing if not destroying this important crop." The wheat crop, when taken after a clover ley, is sure to suffer worse after this than after any other crop; indeed, says Mr Cur-

tis, "where white clover or suckling and rye grass layers have been left for seed, it is scarcely possible to get a wheat crop on account of the wire-worm."

As regards the soils most likely to favour the development and habits of the wire-worm, a few notes will be useful and suggestive. Land bordering on marshes, and consequently with a springy and friable soil, is very subject to attacks of the wire-worm. Gravelly and sandy soils have, in some neighbourhoods, been found most affected. Waste and wood lands, and old pastures, are harbours for the wire-worm. As a rule, it may be accepted that "gravelly and sandy soils most infected; strong loam and clay most free from them."

B.

THE CONSTRUCTION AND EXPENSE OF PLANTATION ROADS.

By JAMES RAIT, Land-Steward at Castle-Forbes.

OF the various improvements which may be effected on an estate, there are none which pay more surely than good roads, and yet there are few which are more generally neglected. If this observation holds true with regard to arable land, much more does it hold good with regard to plantations. Here, what ought to be the first subject of consideration is usually among the last. How comes it that timber of foreign growth is, in many instances, worth ten, or even twenty, times more in this country than it is in its native forest? The quality is no better at the end of its journey, rather the reverse. It arises almost exclusively from the difficulty and expense of transport. Were there increased facilities for bringing it to market, the value to the original owner would be proportionately enhanced, and the consumer would be none the worse, to say the least of it. The evils attendant on bad roads in this country are less only in degree. They lead to a serious expense of horses and wheeled carriages, and to a great loss of time.

When a plantation is offered for sale, it is quite common for a timber merchant to remark that, had it not been for a mile or two of bad road, his offer would have been higher by many per cent. The state of a road determines whether a load shall be 15 or 30 cwt. It is a matter of no little importance whether a purchaser shall have it in his power to transport a given quantity of timber with one pair of horses, or be compelled to employ two pairs to do the same work, thus increasing the expense cent per cent.*

* For further remarks by the present writer on this subject, *vide* 'Relative Value of Round and Sawn Timber.' Edinburgh: W. Blackwood & Sons.

We are apt to wonder why many of our old and much-frequented public roads follow the track that they do, and are ready to imagine that road-making is now so much better understood that no sane man would follow the same path. The subject admits of easy explanation. There was little traffic when those roads were commenced. The first passer-by had no intention of laying off a line of road; he simply took what happened to suit his purpose best for the time. Others going in the same direction followed his steps, and thus what at first was a random track came in time to be recognised as "the road." When increased traffic required increased facilities, it was the easiest and readiest way to "improve" the old track. Thus it has proceeded, till more money has been expended in "improving" what ought never to have been a road, than would have made a new one along a path by which double the weight could have been carried by every cart that passed. In such manner a large proportion of plantation roads have arisen. Usually, small quantities of timber are taken out from time to time at the earlier stages, and the owner is content to make the most that he can for the time being. In the same manner, those intrusted with removing it take the path that happens to be most convenient for the day. When heavier draughts demand imperatively that more attention shall be given to the matter, the readiest plan is again adopted, the former paths are "improved" from time to time, and so much is thus expended on forming what, after all, can only by courtesy be termed a road, that the owner is unwilling to commence what ought to have been his first work—a good plantation road.

With regard to public roads, the state of matters is, in some measure, excusable. What is everybody's business is nobody's business. The amount of traffic was not at first foreseen, and now contiguous arrangements are such that it would be both a difficult and an expensive affair to alter. The owner of a plantation has no such excuse. He, or those acting for him, ought to know and make provision for what must, sooner or later, be done. Where this is neglected, the results are easily foreseen.

I purpose to offer in this paper some practical remarks on laying out lines of plantation roads, the different methods of construction, and attendant expenses.

Before commencing to plant a piece of ground, the principal lines of road likely to be required for removal of the timber should be marked off and left unplanted. When this is neglected till the trees are grown up, they obstruct the view, and occasion no little difficulty in fixing on what is, on the whole, to prove the best route. It often happens that what would be the best line at one point is all but impracticable at another; and if there are difficulties before planting, they are much increased after. The writer of this article happened to have to do with an extensive tract of plantation, upwards of 40 years old, in which it is probable that animal of horse kind never be-

fore set foot. There, in striking out lines of road, the timber grown on them defrayed the expense of construction. This, of itself, was a matter of some importance, but it was attended by evils which more than counterbalanced the advantages. The trees left near the lines of road were far less able to withstand high winds than if they had grown up exposed to them, consequently many were thrown down by gales of wind, and unsightly and unprofitable gaps left; while those which did stand were, in numerous instances, much injured by the tempest. Such evils are prevented by leaving sufficient breadth of blank lines at the time of planting.

Plantation roads may be arranged into three classes—(1.) Those which must be substantial, and capable of standing daily tear and wear; (2.) Those which are to be less frequently used, and which, therefore, may with propriety be constructed on a less expensive scale; (3.) Trail-roads, or those by which a horse may drag trees along to points accessible to carts. These three classes will be noticed in succession.

A person about to lay off a line of road must have certain fixed points between which he desires to carry it. In deciding on these points, the first object of consideration is the direction in which the market for the matured timber may be expected to lie: in that direction the principal lines must tend. Till lately, the first subject of study was where a sufficient amount of water-power for cutting up the timber was to be found. Happily the easy application of steam-power in the present day has made that a matter of less importance. Where the site of a plantation is hilly, it is frequently advisable to take a general view of it from a rising-ground opposite to it. From such a position the prevailing direction in which the proposed road should run is more easily observed, and a general idea of where the branch roads should strike off is obtained with increased facility.

On commencing operations on the ground the person engaged should have a plentiful supply of wooden pins—say 3 to 6 feet long. Beginning at one of the fixed points, he goes along what he *supposes* to be on the whole the best line, sticking up a pin at short intervals till the other point is reached. The pins should never be farther apart than to admit of three of them being seen at one time. After the route is gone over thus, it is very probable that many of the pins will require to be moved up or down, in order to avoid, so far as practicable, rocks, hillocks, bogs, &c., thus improving the line and lessening the expense of construction. A little extra trouble at this stage of the operations will be amply repaid by the sight of a well-laid-off line; and a few hours, or even days, spent in planning, may be worth the labour of many days in executing, and will never give cause of regret. When it is necessary to lay out a line of road in a growing plantation, trees should never be marked, as it is occasionally found advisable to make alterations, and marked trees are apt to lead to mistakes in felling.

As brushwood, soil, and other debris from the higher grounds, are very apt to collect on plantation roads, causing water to stagnate, a rolling surface is preferable to a level one, even where the latter is attainable. Undulations assist in throwing off the water, which, if allowed to remain, mixes with the soil, and acts as a poultice to soften and destroy; on the other hand, if permitted to run long distances it acquires such force as to do more damage than the passage of many heavily-loaded carts. Every road should be laid off with a view, not only to what is best for itself, but also to its bearing on others connected with it, otherwise junctions may be necessary at awkward points, and four lines be required where three properly placed would have answered equally well.

It is an object ever to be aimed at to have roads of every description as nearly as possible free from moisture. If not dry naturally, they must be rendered so by artificial means. A smooth grassy ridge will bear a wonderful amount of traffic if kept free from wet. On the other hand, a road on which a good deal of labour has been expended will soon be injured if left to the influence of water, whether it come from above or underneath. In plantations of any extent, the roads which are to be most used should be most substantially constructed, and also be most nearly level. The degree of steepness limits the weight of loads which can be removed. It is of less importance to have smaller-sized loads in the centre of a plantation than towards the point of egress. As minor branches diverge from the main lines they may be more or less steep, so as to meet the requirements of the plantation. By them larger or less loads can be brought forward to the junction with the main line, and additional quantities put on the carts from piles stored there for the purpose.

The amount of traffic to be provided for, the nature of the bottom, and of the materials available for making a road, serve to determine the method of construction. Generally, it will be found advisable to metal all that exceeds half a mile in length. Where the bottom is dry and tolerably smooth, shorter distances usually do not require it, more especially if good gravel is at hand. Over short distances the natural sward, protected from a flow of surface-water by an open ditch on the upper side, is often quite sufficient, and the ruts made by carts crossing only occasionally, naturally close of themselves, or do so with little help.

On moderately level ground the width of roads intended for plantation purposes exclusively will answer about 15 feet, 10 being composed of best materials, and $2\frac{1}{2}$ at each side of secondary quality. This will be found sufficient to allow a loaded and an empty cart to pass each other. Where a road runs along a steep hill-side, 12 feet wide will answer if care be taken to have broader spaces at intervals of fifty to a hundred yards, as the nature of the ground may indicate. The whole pith and marrow—the sum and substance of roadmak-

ing, is to have the way *firm* and *smooth*. The materials may be anything if this object is gained. After the line is laid off, the sole matter of study is how firmness and smoothness are to be attained and maintained. On level ground, or on an inclined plane, where the road runs nearly at right angles to the base, a ditch is required at each side. On soft ground these ditches should be about three feet deep, but on a hard bottom eighteen inches will probably be sufficient. In either case the sides should be sloped at an angle of 45° , and the bottom not less than nine inches wide. When a road is to be gravelled or metalled, all vegetable mould should be removed if not more than twelve inches deep. All stones, other than rock, must be removed, or thoroughly broken up. Where large stones are left, they serve to displace the materials put upon the road, and thus occasion holes and ruts without end. In order that the finished road may remain smooth, great care should be taken to have the bed on which it is to be laid firm alike along both sides. A hard side and a soft are sure to work mischief; while, where both sides yield alike, a good road may be upheld with little repair for many a day.

When it has been decided to metal a road, a box or longitudinal trench has to be prepared for reception, and width of the proposed metal. This should be 6 to 8 inches deep, and highest along the centre. If the bottom is not naturally firm, 2 or 3 inches of good open gravel should be spread uniformly over it. This serves to prevent the metal from sinking, and the mud from rising through it. The most approved method of putting metal on a new road is to break it before carting it on; but this is attended with so much expense that I have almost uniformly carted on the stones whole, and broken them into their places — a bottom layer of about 5 inches deep, and an upper one of 3 inches. The size of the metal should never be allowed to exceed $2\frac{1}{2}$ inches in any direction in the former, nor 2 inches in the latter. The serviceableness of a road depends much more on the degree of fineness to which its metal is broken than on the quantity of mere stone put into it. I should prefer 6 inches of well-broken metal to 12 inches with each lump of stone like a man's fist. The surface of the road should be curved for the purpose of throwing off the water more readily — in other words, the sides of a road 15 feet wide should be 12 inches lower than its centre when completed. At intervals of fifty to sixty yards spaces two feet wide should be metalled out to the side-ditches in order to drain off the water from the metal. Where the road is on a lengthened incline, provision should be made for preventing water from running along the surface, either by gutters, or, what I have found still better, by slight mounds of metal of this figure Δ , the lower angles running out to the side-ditches. If these mounds extend only the general width of the metal, the first cart that happens to pass in a wet day may go on the side-road, creating

a rut which will carry the water on with increasing force. Gutters are apt to silt up, and on this account I consider them objectionable; but where they are preferred, they should not be causewayed, as causeway stones are sure to get displaced by jerks, and they create ruts immediately beyond them. In constructing plantation roads, provision is often at best made simply to *let off* water. It should be *made* to go off, and nothing less deserves a moment's attention.

As soon as a few hundred yards of metal are arranged on the road, it should be well rolled with a heavy roller: this serves to make the stones take their places at once. Stone rollers for this purpose are commonly about three feet long, and eighteen inches to two feet diameter; but any sort of roller is better than none. The depth of box already specified will have left the metal higher than its due proportion to the side-roads. The difference should now be made up to the proper height by good clean gravel. A coating of the same should also be laid uniformly over the metal, and the whole be made thoroughly firm and smooth by repeated application of the roller.

When it is necessary to repair a metalled road, the old metal should be carefully picked out of the ruts and cavities. If this is neglected, the new metal cannot incorporate with it; has no support—nothing to save it from abrasion on all sides. It lies as if in a mortar, and is pounded to powder by every passing wheel. When the old is picked up, it and the new sink down together into the opening, and form a compact body, exposed to wear on the surface only. Autumn is the best season for executing repairs on roads of this description, as the softening occasioned by the rains and early frosts allows the stones to take their permanent places more readily than if done in the dry season.

When a road is to be made with gravel, as much care ought to be exercised to have it smooth below as in the case of metalling. Six to eight inches of good clean gravel, properly prepared, will bear a large amount of traffic, always provided it is kept clear of water, whether running or stagnant. When the gravel is being laid on, the person in charge must be careful to break all stones found, and keep them forward, so as to be undermost. If left on the surface they produce ruts and holes. Whatever sort of materials go to form a road, let them be as nearly as possible of uniform quality at any given depth. Gravelled roads, more especially, may be expected to be most durable when carried over an undulating surface.

An inexperienced person is apt to fancy that it will be more difficult to make a road along a hillside than on level ground. As a general rule it is not so, if it is not necessary to make it of extreme breadth: in such situations I have found a clear roadway of 12 feet sufficient for plantation purposes, care being taken to have recesses at short distances for allowing carts to pass each other, as

already indicated. Let the slope of the hill be what it may, the materials excavated from the upper side will be found nearly equal to the requirements of the embankment on the lower. Before commencing excavations all vegetable mould should be removed from the contemplated line of road, otherwise, as it decays, the embankment on the lower side will subside more than it ought to do, and occasion awkward displacements. After the soil is removed, a level bed 18 to 24 inches broad should be prepared along the lower edge of the embankment, and on this one or more rows of stones, or other suitable materials, be carefully placed to prevent the embankment from commencing to slip. The angle or slope at which an embankment requires to be raised depends entirely on the nature of the materials used in construction; where these are soft or incoherent, a slope of 1 to 1 may be necessary, but where of substantial stone-work, 1 foot in 6 or 8 may be considered quite sufficient. The side of the road lying along the top of the embankment should be made rather higher at first than it is meant ultimately to stand, as, after every effort is used to have it firm, it will sink more or less; and if proper precautions are not adopted to prevent it, it will subside too far. This, in the case of a metalled road more especially, is a great evil, and should be carefully guarded against. For the purpose of preventing carts from going too near the edge of the embankment, and thus forcing it out, good large rounded lumps of stone should be firmly placed at short intervals along the verge, and thus compel careless carters to keep at a safe distance.

In constructing roads along steep hillsides I have found it advisable not to cut anything of ditch except the slightest kind on the side next to the solid bank; a deep one would occasion very much increased expense; besides, in such a situation it is sure to get rapidly filled up with rubbish from the upper side, and to be continually in the way. The road should be made to slope considerably from the centre to the base of the solid bank, and any water that falls on that side be allowed to run along to the most convenient point for crossing, or be led along under the road and through it in a covered drain. Where there are indications of wet on the higher ground, a series of open ditches in a zig-zag direction should be cut, so as to collect and conduct water to the proper places for crossing in drains under the road. The best situations for these drains are the hollows, so that if they get choked by snow or debris, the water in crossing may do the least damage possible. The bottom of each covered drain should be causewayed, in order that currents of water falling into or running along them may not undermine the structure.

Trail-roads, or paths in the forest to permit horses to drag one or more trees to situations accessible to carts, should be made to run as much as possible right up and down hill, with a turn at the

lower end in the direction that the timber is to be driven. When trees are dragged *along* a hillside they are apt to strip the bark from the growing timber. In most cases all that is required with this description of road is to remove stones and roots, and to drain the water off marshy spots that may happen to be in the way.

Situations, materials, and wages differ so widely in different parts of the country, that it is difficult to state anything like a definite rate of expense for roads such as those now mentioned. Plantation roads are sometimes required at long distances from the residences of workpeople. In some districts stones may be had in any quantity, and at next to no expense. This is the case over a large part of the north of Scotland; but even there the nature of the stones differ so much, that at one end of a parish it will cost double the expense to provide and break the metal for a road that it will do at the other end of it. In other parts of Britain, such as that of Buckinghamshire before the introduction of railways, stones cost as high as 8s. to 10s. per ton. Again, in many parts of England, wages range from 12s. to 14s. per week; in the south-west of Scotland, 11s. to 12s.; and in the north-east, 15s. to 16s. In such circumstances I must content myself with stating facts that have come under my own notice. In preparation for making a piece of road through a plantation thirty-five years' growth, I advertised for contractors. The trees grew thickly on steep ground. There was difficulty in seeing a few yards along the line, and the intending offerers got many tumbles before making up their minds. The specifications bore that the width was to be 12 ft., the upper side excavated, and the lower side substantially built, 9 ft. wide to be metalled (for this there was abundance of stone by the way). After the metalling was finished, the whole width of road to have a fair coating of clean gravel; in fact, the work much in accordance with the specifications already given. The offers ranged from 8½d. to 3s. per running yard, the greater number being 1s. to 1s. 3d. per yard. The offer of a trustworthy workman at 9½d. per yard was accepted. He did it at the rate of about 2½ yards per man per day, and was quite safe with it, wages being low at the time. Many of the offerers appeared to forget that although a large number of stones were in the way, the position of the road along a steep bank gave great facilities for getting quit of them. The person who executed the work was accustomed to these things. Another section required to be the same width, but on more level ground, and not metalled. It was done on day's wages by the same men, and at the rate of 8 yards per man per day. A third section was along the face of a granite rock, which had to be excavated, by blasting with gunpowder, to the depth of two feet on the upper side, and built with the stones on the lower. It was done at the rate of about 2 lineal yards per man per day. To the expense of these two latter sections there fell to be

added the cost of metalling and gravelling where necessary, also the expense of open trap-drains. Another road, 12 ft. wide, had to be made in a plantation fifty years' growth, situated on a hill-side. Being on a gravelly bottom, it was not necessary to do more than remove the trees and soil, and to bring it into proper form by removing the gravel from the upper to the lower side. The lowest offer by contract was 6d. per running yard. It was done on day's wages at 3d. per yard, wages at the time being 12s. per week. When open ditches have been required, I have generally got them cut 18 inches deep, 9 inches wide at bottom, 36 to 45 inches at top, all stones other than rock removed—cost, 1d. per running yard. When wages had risen to 15s. to 16s. per week, a new road had to be carried along a hillside, the hill having a slope of 1 in 6 to 1 in 10. It was situated about 1000 feet above the level of the surrounding country, and about an hour's walk from the residences of the labouring men of the district. The hill gives evidence of having been more than once convulsed by some of the tremendous operations of nature. On the surface lay peat-moss, generally 6 to 12 inches-deep, but at two places 60 to 70 inches. Under this was found a layer of large stones, many of them several tons weight, but all comparatively loose, and easily toppled over and sent downhill. Under these again lay a thick coating of gravel, clean and hard, and below the whole solid granite rock. The contractor had to clear off all the peat-moss, remove the stones, or so arrange them as to leave a smooth, solid, well-formed road, 12 feet wide. He had also to construct gutters at some 50 or 60 yards apart. The whole line of road had to be excavated, but the depth of moss prevented any embankment from being required. The expense was 1s. per running yard for one section, and 1s. 2d. for another. Although this line of road was laid off entirely by the guess of the unassisted eye, the Royal Engineers remarked that it was the best-laid-off hill-road that had ever happened to come under their notice.

Nothing conduces more to keeping roads of any description in good repair than having the ditches well scoured and the surface frequently scraped. If these two things are neglected, the best-constructed road will be destroyed in a very brief space of time. Most roads receive more injury from neglect than they do from tear and wear. Above all things, keep water off them as much as possible. Attention to this will save a large percentage of expense of repairs.

In attending to commutation roads, I have been in the habit of keeping them 18 to 20 feet wide, exclusive of ditches; the metal 10 feet wide, 9 to 10 inches deep, and well broken, the side-roads well covered with clean gravel, and a blinding of gravel above the metal. The expense, as a matter of course, has varied with the nature of the ground and of the materials. I have got a 10-feet-wide box taken out on an old road, the stones (primary formation) quarried from the rock, broken in and blinded, at 9d., 10d., 11d.,

and 1s. per running yard ; and have in some cases had to pay as much for gathering them in adjoining fields and breaking them in. Stones lying for some time on the surface of the ground are usually much tougher than those newly taken from the quarry, and consequently are more expensive to break. In giving these statements I have not made allowance for carriage of materials.

WATER, AND ITS AGRICULTURAL USES.

No. I.

OF water, considered in its various aspects as a source of health and nutrition to the occupants and stock, of increased productiveness to the crops, and of a power available for use to economise the labour of the farm, we propose in the present series of papers to treat. Within these limits we hope to be able, not only to gather up what has been said by competent authorities, whose opinions are worthy of all respect, but also to be able to present such opinions, or to explain such propositions of our own, as may have a bearing, more or less practical, on these various aspects of the subject.

It is a very curious and suggestive circumstance that respecting the two elements most essential to the maintenance of life, air and water, there should be not only such ignorance as to their characteristics—how best they can be supplied and maintained in purity—but also such an astounding degree of indifference about that supply and that purity. Not quite so bad are some certainly as the sea skipper who stated that the only use he ever put water to was to mix with rum, and it always spoiled it ; or like him who stated that he once had used it, but did not like it, and knew nothing or cared nothing about it—give him his brandy, the water might go where it liked. Still, exaggerated absurdly as such statements are, and good or not, as the case may be, as jokes, still they convey a good deal of sarcastic truth as to the positive ignorance which prevails even amongst educated men as to what water is, what are its characteristics, how best it can be economically used ; and further, as to the still more widespread indifference there is as to the qualities used for various purposes of life—an indifference which spreads to the fact that it seems as if they thought that all qualities were alike—that if it simply presented itself to them in its usual form, that all was right. This public and widespread indifference, not only as to the qualities of water, but to the means by which a supply of it, such as it may happen to be, can be obtained, is one of the most striking contrasts which our social condition presents to that of ancient

communities. It is interesting, in perusing the records of other people who have earned for themselves a place in the tablets of the world's history, to see how every now and then something crops up which shows what was the estimation in which water was held, and how complete, and in many cases how gigantic, were the means adopted, by which a supply of it could be obtained both for the maintenance of animal life and for the purposes of agriculture. How interesting is it to come across the quaint notices of the kindly act done by some, of digging in the desert a well, round which the flocks of a Jacob might congregate, and to which the village maidens, as Rachel and Leah, would wend their way at eventide. The building of a fountain, or the digging of a well, was looked upon with veneration, as one of the most beneficent acts which man could do to his fellow-men, as their destruction was denounced as one of the most malignant. The history of ancient people, alike in the Old World and in the New—in the deserts of Syria, the plains of Egypt, of India, or in the wide prairies of Mexico—abounds with allusions to the wells, the reservoirs, the aqueducts, the canals, all constructed with the greatest patience, and maintained with the most painstaking care, to supply the wants of domestic life, or to minister to the no less urgent necessities of vegetable existence. But it is while examining the history of those wonderful people, the Romans, of whom it may be truly said that, masters of the world, they were slaves to their own vices, which ultimately hurled them from the throne of the world, that we find the most striking evidences of the high estimation in which water-supply was held. At first supplied from the "mighty Tiber," or from the springs and wells of the neighbourhood, the wonderful increase in the number of inhabitants of the city rendered more complete means of supply a necessity, so that, about three hundred years before the Christian era, Appius Claudius inaugurated the plan of bringing water from a distance, thus securing not only pure water, but also an abundant quantity of it. To carry out this plan the most magnificent schemes were carried out, both by him and by his successors, during several centuries—the grand feature of these schemes being the erection of magnificent aqueducts, remarkable not only for their gigantic height, some reaching to three tiers of arches, but for their astonishing length, one—that erected by Appius Claudius—reaching to a distance from Rome of forty-seven miles. We may form some notion of the magnificent care which characterised the Romans in this department of social economy, when we draw to mind the fact that at one period in their history no fewer than twenty aqueducts stretched across the plain surrounding their city, bearing, from distances more or less extended, but in the aggregate reaching to the astounding length of 255 miles, the daily quantity of three hundred millions of gallons. It was one of the characteristics of this wonderful people that they did not simply carry to other countries their conquering arms, but also the

evidences of their civilisation ; so that, in the provinces over which they had rule, arose, under their fostering care, aqueducts as magnificent as those which graced their central source of power. Thus in Spain, in France, in Portugal, and in Germany, large aqueducts were raised. Of these, the most important was that at Nismes. This was thirty miles in length ; and, crossing a country remarkable for the irregularity of its surface, it had to pierce, as it was made to pierce, hills, to cross valleys, and span rivers. The portion of it known as the Pont de Gard presents to this day a fine example of these magnificent works of the old Romans. It is made up of three ranges of arches. The lower range nearest the river which it spans is composed of six arches, but, as the valley widens, the arches increase in number, so that the second range is made up of eleven arches, the third range having thirty-five arches, and reaching a height of 160 feet. The aqueduct which spanned the Moselle in Germany, conveying water to the city of Metz, was made up of lofty arcades, 3600 feet in length and 100 in height. It would be easy, as it would certainly be interesting, to trace many historical details of this kind connected with the care which this point of water-supply received from the ancient nations, but space does not permit of this. Suffice it to say, that not only in the Old World was this care displayed ; for if we go to the New, and trace what records of its history we have at disposal, we find that in Mexico, Chili, and Peru fine and extensive works were carried out ; and to this day many relics of these are presented to the traveller "in splendid public works, which rival in magnitude those of Egypt and India. Remains of aqueducts, of great magnitude, skilful workmanship, and beautiful simplicity, still attest the industry, wealth, and science of those countries before the Spanish invasion." In Central Mexico remains of vast reservoirs are met with, which prove the care the inhabitants had to provide large supplies of water to those villages and cities. Enough has been said to prove the estimation in which this important department of social economy was held by the peoples of the Old and the New Worlds in times gone by ; and it serves as a contrast, as painful in its results as it has been disgraceful to us as a nation, which our country has exhibited but a few years ago, if it does not still exhibit. Nothing, indeed, by way of contrast, *could* be more striking. London, the largest city in the world, has only recently been well supplied with water ; for of its condition in this respect some idea may be formed by the fact which has again and again been reiterated, that in many of the poorer districts water was dearer than beer ; indeed, it could be more easily obtained. Beer, it has been jocularly said, can be got anywhere and everywhere in London—next door, over the way, or round the corner ; but it is a truth which carries with it an immense amount of painful suggestiveness, that not many years ago, in certain districts and at certain times in these districts, water could not be had even for money. Let us be

thankful that all this is being rapidly changed, if indeed it is not in many districts already changed. With the town or city aspect of the question we have, however, in this paper no concern; we therefore pass on to its rural aspects, and the first thing which strikes us in connection with this is the curiously suggestive fact, that in country villages, no less than in the case of isolated country-houses, the question of the supply of water is one which gets little or no consideration; and water in one form or another being obtainable, little concern is felt by those using it as to whether it is fit for use or otherwise. Much has been written about the sanitary condition of our towns and cities, and glowing or gloomy pictures have been drawn as to the evils which arise out of this condition; but somehow or other our sanitary inspectors always confine—or at least *almost* always confine—their care to the cities, overlooking quite the country villages, hamlets, or houses; the result of which is that a large amount of ignorance prevails amongst us as to how things really are in these remote and out-of-the-way places. A search, however, into the circumstances of these rural districts will result in establishing the fact that sanitary evils are connected with them as striking and as painful as those connected with many of our town districts, about which so many woful jeremiads have been raised. This of the water-supply question is one in connection with which not a few startling evils may be traced; for in many cases in rural districts it is easy to meet with cottages which have no direct supply of water given to them. Upon their inhabitants is too often entailed the labour—all the more painful and all the more uncalled-for after a day's work at their special calling—of going to some distance from their houses to get a supply of water. Nor is it seldom the case that this supply is quite unfitted for healthy use. The whole subject of water-supply to the cottages of our labouring agricultural population is one which has never met with, but assuredly demands, the earnest consideration and care of those who are mainly interested in the maintenance of their healthy condition. We may probably, in the series of papers now commenced, be able to point out some of the requirements of the case, and how best they can be met; meanwhile we shall proceed to take up the different aspects of the subject under, first, the *chemical and physiological*; second, *cultural*; and, thirdly, *mechanical* characteristics of water.

We have three sources of water available—rain, spring, and river. Of these three the most obvious, and one which presents itself to our notice most readily, is that of rain. Let us glance at the characteristics of rain-water, which for washing purposes especially is the most valuable of all supplies generally obtained—and it is fortunately easily obtained; that is, if we are wise enough to make provision for storing it up, a wisdom too frequently, we are sorry to say, lost sight of completely—but more on this

point hereafter. We have said that rain-water is the most valuable for washing purposes : it is so for cooking also, if properly filtered ; indeed, next to distilled water, it is the purest of all waters placed at our command. Dr Hassall indeed says that, as the result of very numerous examinations "of rain-water, immediately after its descent to the earth, obtained both in town and country," he can "confidently assert that it does not in general contain any form of living vegetable or animal matter." But although rain-water is obtained, in the first instance, free from organic animal or vegetable matter, still it possesses a remarkable affinity for such organic impurities, so that in this, and the consequent rapidity with which it becomes tainted, lies the chief and only objection to its use for cooking or drinking purposes unless carefully filtered ; and even in some cases so decided does the taint become that filtering even does not remove it. There are, however, certain modes of storing it up by which this taint, if not altogether prevented, can at least be greatly retarded in its coming on ;—what these are we shall presently explain. But in the one great fact that there is no water at all equal in value to rain-water for washing purposes, whether of person or of clothing, lies abundant reason why every means should be taken, from the humblest cottage to the largest mansion, of saving and storing up the supplies of rain-water which fall upon and pass off from our roof-surfaces. Those who have been once accustomed to the *delicious effect of rain-water in washing the person* will grumble most grievously at being obliged to wash, as he may at times be obliged, with hard spring or river water. The one is a woful necessity, the other is a positive luxury. But it is in view of the saving effected in the washing of clothes that perhaps the most striking advantages of rain-water are seen. And really this is such a most important point, bearing upon the best interests of the working portion of the community, who can ill afford to waste clothing, that we may remark on some of the points involved in it. Taking the cost of a working man's shirt made of calico at three shillings, the number of times which it can be washed before it is completely worn out at forty, and the charge of washing each time at twopence, we find that the money spent on washing is more than double the cost of the shirt. And in this calculation the items are all too favourable. Thus, in the ordinary or normal condition of the cotton trade, the cost of a shirt will not be three, but only two shillings ; while the cost of washing in London will not be twopence, but threepence ; so that, in ordinary circumstances, a sum five times as large will be spent in washing a shirt than the actual cost of the shirt. Now, by the use of hard water, not only is the wear and tear of the material vastly increased, its cleanliness and purity much less than when soft water is used, but a much larger quantity of soap is required. There can be no doubt in the minds of those who happen to know what washing is, in the "rugging,

tugging, and tearing" which the process involves, that clothes are more worn in the process than in that of wearing. The less frequently, then, clothes are required to be washed the greater the saving; and it is perfectly indisputable that, when washed with hard water, they are never so pure, and therefore get more rapidly dirty, than when soft water is employed. Then, as regards the saving of soap, Mr Donaldson has made the following calculation:—"For every hundred gallons of water used in washing, two ounces of white curd soap is required for every degree* of hardness of the water used. Thus, a water of 5 degrees of hardness takes 10 ounces of soap; and one of 15 degrees takes 30 ounces. I find that 14 lb. of soap per individual per annum is about the average consumption of yellow soap for washing and domestic use, and the price is about 5d. per lb. Therefore

100 individuals using water at 15° of hardness take 1400 lb.	
of soap at 5d. per lb.,	£29 3 4
And with water at 5° of hardness, 400 lb.,	9 14 3
Difference,	£19 9 1

In round numbers, the saving in soap by using water 5° hard instead of 15° is £20 per hundred individuals, exclusive of the wear and tear of clothes from washing in hard water which will fully equal the saving in soap." The following is another estimate, showing the difference between the cost of washing for a certain period by the use of hard water of 15°, and during a similar period by the use of soft rain-water:—

Soft Water.				Hard Water.			
		s.	d.			s.	d.
Soap, . . .	½ lb. at 6d. . .	0	3	...	1½ lb. at 6d. . .	0	9
Soda, . . .	½ lb. at 1½d. . .	0	0½	...	1½ lb. at 1½d. . .	0	1½
Labour, . . .	. . . . .	5	0	...	. . . . .	10	0
		5 3½				10 10½	

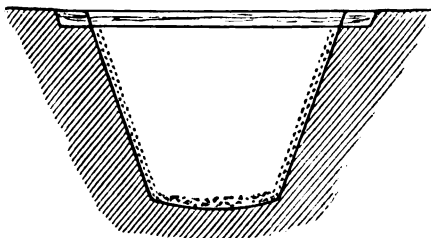
From this will be noticed another fact—the great difference between the cost of labour in the two cases. All this may, by some, be thought of very little practical utility; but while by no means placing full faith in the accuracy of such figures, we nevertheless maintain that it is incontrovertible that by the use of soft rain-water not only is less soap used, less labour required, but that the wear and tear of clothes in washing is very greatly reduced. And seeing that these things are so, we farther maintain as incontrovertible that it will be a much more common-sense-like proceeding to take measures to save the rain-water, which in our climate is poured down so abundantly from the heavens, than to allow it to pass away into drains, or, what is worse, to drip from the eaves of the roof and saturate and sodden the soil at the base of the building, and thus gradually to make the walls damp. We have very decided opinions on this point; and this because we happen to

* What is meant by a "degree of hardness" in water will be afterwards explained.

have pretty wide experience of the advantages attendant upon the use of soft rain-water, and the disadvantages attendant upon the use of hard water; and now, when so much is being written and said about the duty of landlords to their cottagers, and while so much is being impressed upon them as to the duty of economy, it seems but simply fair and reasonable that all means be taken to insure the comfort of this class, and to enable them to practise this economy. A few practical notes, then, on the best means to be adopted in storing up rain-water will not be out of place.

There are three modes by which rain-water can be stored up:—first, by underground tanks; second, by cisterns placed below the roof, but at a height above the bedroom floor sufficient to give pressure enough for the supply of the water-closet on the bedroom floor; and, third, by a cistern placed above the scullery or the privy. The simplest of all modes of making an underground tank for the retention of water is by excavating a hole in the soil sufficiently large to contain a barrel or hogshead. If the inside of this is burned or slightly charred by setting on fire a quantity of shavings and light chips in the cistern, this barrel will last a long time, and form an excellent cistern or tank. It will be all the better if the outside is charred also, and the earth carefully rammed up against it. A large flag-stone will form a cover for the whole. Where a large barrel—an oil-cask forms an excellent cistern—cannot be obtained, or a more lasting mode be deemed advisable, the next simplest plan is to dig a circular excavation in the soil, and line this with a pretty thick layer—say an inch—of hydraulic cement. This lining will be very difficult to place upon the face of a perpendicular wall so as to be retained till it hardens. The best way is, therefore, to make the sides sloping

Fig. 1.



so as to make the bottom diameter smaller than the top, as shown in fig. 1. One disadvantage of this form is, that the upper diameter is so large that it is difficult to find a stone large enough to act as a cover. When made in this form the cover may be made up of planks, laid side by side and clamped with iron—an aperture being left in the centre through which the water is withdrawn. In making the hydraulic lime with which to line this cistern, care should be taken not to mix more than two-thirds of sand with the hydraulic lime; and it is essential to have the sand as pure and clean as possible, and thoroughly free from all saline substances; washed river-sand should therefore be obtained. The best way to use the hydraulic lime is to mix up only small portions at a time with water—

taking care to spread it evenly over the surface, and to leave the outer edges of each portion done rough, so as to act as a key to the next portion put on. When properly made and put on, the hydraulic cement will set as hard almost as stone, and will last a long time. An excellent hydraulic cement will be made by mixing four parts of lias lime, six of river sand, one of calcined limestone, and one of puzzolano. Puzzolano is a volcanic concrete thrown up from Mount Vesuvius; it may be artificially made by burning clay. Another mode of making a lining for cisterns is by mixing $2\frac{1}{2}$ parts of chalk with one of lime, and with as much

water as will enable the whole to be laid easily over the surface. Cements are now, however, sold ready for use,—all that is required is merely to add the water necessary to make the consistent plaster. Of these, the Portland cement is the best—it is possessed of great strength, and is lasting.

But by far the most satisfactory way of making rain-water tanks is to dig out the necessary circular excavations, and line the inside with brickwork. In figs. 2 and 3 we illustrate two modes of making

Fig. 2.

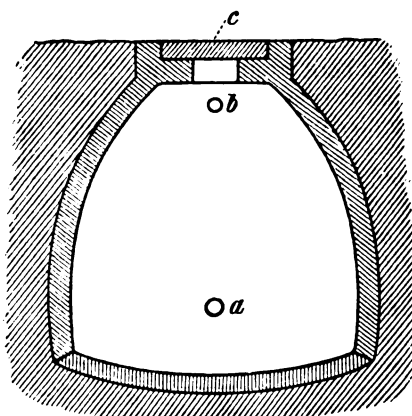
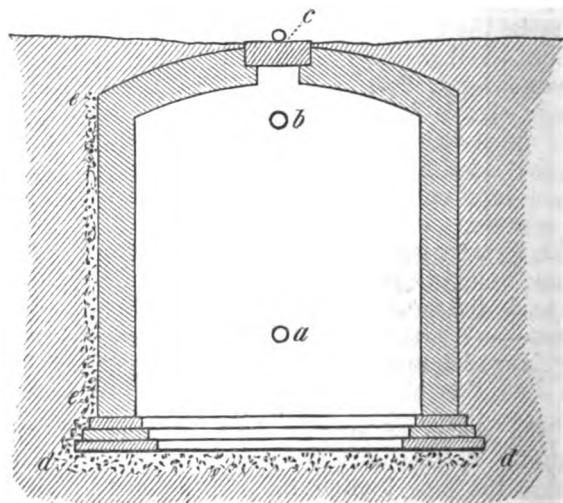


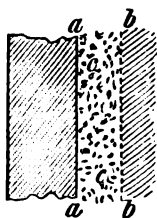
Fig. 3.



tanks : in both of these *a* is the inlet-pipe leading from the roofs, *b*

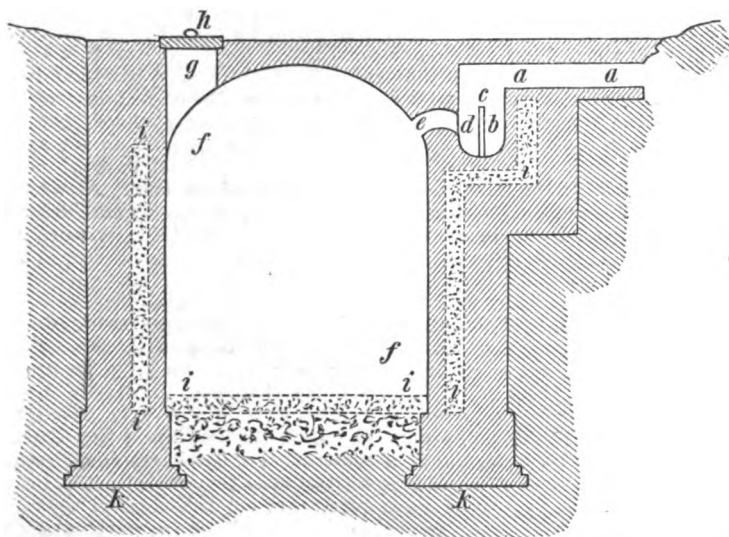
the outlet or outflow pipe, *c* the stone cover. The form in fig. 2 is the strongest. If the ground is of a soft, yielding, or treacherous character, it will be advisable to place below the bottom a layer of concrete, as *d d*, fig. 3; concrete made of broken stones, bricks, or gravel—the last is the best—and lime, five parts of the former to one of the latter—the layer of concrete being at least 12 inches thick. If the soil in which these cisterns are constructed

Fig. 4.



be dry, the bricks may be set in ordinary mortar; but if wet, hydraulic lime should be used. In all cases, if a perfect job is desired, the earth should not come close up to the wall (*a a*, fig. 4) of the tank, but a space should be left between this and the earth (*b b*), into which clay—or puddling, as it is termed—should be hard rammed. In constructing tanks of this kind it is essential to have the brickwork carried regularly and uniformly up, no course exceeding two feet in height; as soon as one course is carried up all round, the puddling (as *c c*, fig. 4) should be well rammed in behind the wall (*a a*). When this is done up to the level of the top of the course, another course of brickwork should be carried up, and then puddled behind, and so on. In fig. 5,

Fig. 5.



we give the sketch of another form of tank, or underground cistern, similar to that used in some parts of the Continent. In this *a a* is the pipe leading the rain-water to division *b* of a small cistern, *b c d*. This is divided by a partition *b*, made up of

a perforated metal or wood board, to act as a species of filter or sieve to catch leaves, &c., and to prevent them from flowing into the cistern. From the division *d* of *b c d* the water flows by the tube or passage *e* into the cistern *f f*. The manhole *g* is covered by the stone-flat *h*. In this construction the puddling is placed between two thicknesses of wall, and is specially adapted for treacherous soils; the bottom puddling *i i* rests on a layer of concrete, which, if necessary, can be carried farther down than shown in the sketch, so as to be below the wall-footings *k k*, and on which they will rest. The following description of a mode of forming tanks, introduced by Mr Waistell, will be useful here:—

“It is circular in the ground plan, with the sides built like a wall. The bottom should be in the form of a flat dome reversed; and the top also domical, with an opening left in the centre of sufficient size to admit a man to clean it out occasionally. The top of this opening should be a little above the surface of the ground, and should be covered with an oak flap, with several holes bored in it for ventilation; or the cover may be an iron grating, horizontal, and a little elevated or conical. These tanks may be constructed of various dimensions; the depth and width should be nearly equal. A hole should also be left for the service-pipe, or that which conveys the water into the tank; and also for the pipe for the pump, if the water be drawn out by that means. The water may be filtered previously to its entering the tank; the hole for the service-pipe ought, therefore, to be near the top, and on that side most convenient for the filtering chamber; this may be about 4 feet in diameter and 3 feet deep. Across this, about 12 inches from the side next the tank, . . . a slate partition from the top to within about 6 inches from the bottom should be fixed; at the bottom of the box should be put clean coarse sand or pounded charcoal, about a foot in thickness. The pipe or opening from the filter to the reservoir should be of ample dimensions, and be made at about 18 or 20 inches from the bottom in the small division or space behind the slate. Above this opening, and in any part most convenient, . . . in the large division of the filter, should be an opening or drain to carry off the water when the tank is full. This filter should also have a cover, that it may be cleaned out, and fresh sand or some other purifier put in as often as may be found requisite. Of course, the water as it comes from the roof is to be first conveyed into the large division of the filtering chamber, on the opposite side to the slate partition, . . . and passing through the sand it rises in the small division purified, when it is fit to pass into the tank by the tube *o*. If there are two or more of these filtering chambers, or if they are of greater depth, the water may be passed through the greater quantity of sand, &c., in them, and be still more purified. Both the tanks and the filtering chambers should be water-tight; if constructed of brick, the inner course may be built in Roman cement, and afterwards the whole of the inside covered with a coat of about three quarters of an inch thick of the same material. Water from drains formed in the ground, for the purpose of collecting it for domestic purposes, may be purified by passing it through a sand-filter previously to its entering the tank or reservoir. Sponge or flannel may be used as filters. In constructing tanks of the above description, care must be taken to have the earth closely filled around the brickwork, and to allow sufficient time for the work to get properly settled previously to admitting any great weight of water.”

A few notes on the amount of water which may be made available from the drainage or drip of roofs of farm-buildings, and on the calculations useful in ascertaining the quantity which cisterns will contain, may be of value. To estimate the quantity of rain-water which may be obtained from a certain space of roof, measure the roof, and multiply its length by its breadth, so as to get the superficies; make this into inches; divide the number of inches by 231, which will give the number of gallons for each inch of depth of rainfall. The average depth will be ascertained by the table of rainfall for the district; but it may be taken as between $3\frac{1}{2}$ and 4 inches for each month. The quotient then above obtained is to be multiplied by $3\frac{1}{2}$ or 4, in order to obtain the number of gallons received from the roof in each month. It has been estimated that in the neighbourhood of London the annual supply of rain-water is 4800, say 5000 gallons, for each 400 square feet of roof-surface. A span-roof, then, of 10 feet by 20 on the side, will give this quantity; and from this will be seen what a splendid supply of soft water is within the reach of all possessors of farm-buildings. And as regards cottages and villas, our experience seems to point out this as a rule, that if the whole roof-space be economised, and the water from it be carefully stored up, the supply obtained will be found sufficient for all the purposes of washing of clothes and person, the extent of cistern-space being proportionate to the roof-space, at the rate already stated—namely, 5000 gallons annually for each 400 square feet of roof-surface. Possibly an average for the whole kingdom may be put at—5000 gallons for each 500 square feet of roof-space; so that the proportion, very easily remembered, is arrived at—1000 gallons per year from each 100 square feet of roof-surface. On this point of the supplies obtainable of rain-water in rural districts, a French savant, M. G. de Cause, has been making some curious investigations, of which we here present a brief *resumé*. M. de Cause estimates the roof area of a farm-house of a farm of one or two acres—a mere cottage with us, although the roofspace is often greater than in this country, where compactness is more aimed at—at 90 square yards, and the average rainfall 76 cubic centimetres, which gives an annual supply of 60 or 65 cubic yards of water. The consumption of water in farms he puts at 2 gallons per day per individual for all purposes, cooking and washing, or say $3\frac{1}{2}$ cubic yards per year. A horse will consume five times this quantity, or 10 gallons per day, or $17\frac{1}{2}$ cubic yards per year; a cow or ox 6 gallons per day; a sheep 2 quarts; and a pig 3 quarts a-day. To ascertain the contents of a tank or cistern, circular in form, square the diameter in inches, and multiply the product by .0034, the quotient is the number of gallons for each inch of depth.

The construction of tanks for rain-water has such a close bearing upon that of tanks for liquid-manure, and the calculations affecting the one are so useful for the other, that we make no apology for here

giving two Tables, the result of calculations made by Mr Love, and published by him in the 'Journal of the Royal Agricultural Society.' They will be useful not only in estimating the contents of tanks or cisterns, but also their cost.

TABLE I.

Depth over the Surface.	Gallons.	Cubic Feet.	Tons.	Diameter of Tank.	
				Ft.	In.
0.1 of an inch	2,269	364	11.34	6	10
0.2 "	4,538	729	22.68	9	8
0.3 "	6,807	1093	34.00	11	10
0.4 "	9,076	1458	45.36	13	8
0.5 "	11,345	1822	56.72	15	3
0.6 "	13,614	2187	68.10	16	8
0.7 "	15,883	2551	79.40	18	0
0.8 "	18,152	2916	90.75	19	3
0.9 "	20,421	3281	102.10	20	6
1.0 inch	22,690	3645	113.40	21	7

TABLE II.

Quantity in Gallons.	Depth of Tank.	Diameter of Tank.	Depth of Excavation.	Diameter of Excavation.	Cubic Yards in Excavation.	Stanching-Clay in Cubic Yards.	Bricks for Dome and Bottom and Walls. Standard Size.	TOTAL COST.		
	Ft.	Ft. In.	Ft.	Ft. In.				£	s	d
2,269	10	6 10	12	9 0	28	5½	4,200	8	6	2
4,538	"	9 8	"	11 10	49	8	6,100	12	4	0
6,807	"	11 10	"	14 0	68	10½	7,900	15	7	4
9,076	"	13 8	"	15 10	87	12½	9,600	19	7	0
11,345	"	15 3	"	17 5	106	14	11,000	22	5	4
13,614	"	16 8	"	18 10	124	15¾	12,400	25	3	6
15,883	"	18 0	"	20 2	140	17½	13,700	27	17	0
18,152	"	19 4	"	21 6	161	19	15,100	30	16	3
20,421	"	20 5	"	22 7	180	20½	16,500	33	15	0
22,690	"	21 7	"	23 9	190	22	17,900	36	13	0

" In the first of these tables, the first column shows the depth of dressing which the number of gallons, tons, or cubic feet in the corresponding lines will give to the land. Thus a dressing of liquid manure, equal to a depth uniformly over the surface of an acre of land of one inch, will take 22,490 gallons, or 3645 cubic feet, or 113.4 tons, or the diameter of tank being 21 feet 7 inches. The depth of the tank is assumed to be 10 feet from the springing of the invert in bottom and up to the level of liquid in the tank. In the second Table the cost is given of erecting a tank of any given size; the clay required to pack 4 inches thick behind the brickwork:

the number of bricks required for the interior, 9 inches thick, with a 4-inch top and a 4-inch bottom; with a man-hole $3\frac{1}{2}$ feet in diameter. The bottom is recommended to be concave, forming a portion of a sphere, the radius of curve of which is equal to the diameter of tank."

In treating of the mechanical and chemical impurities of water we shall have something to say on the subject of filtration. Meanwhile we here deem it necessary to conclude the department of tanks by illustrating simply how filters may be adapted to them. In fig. 6 we illustrate the descending system of filtration, in which, *a a a* represents part of the sides of the tank, *b b* a partition of stone thrown across one end, but not reaching to the bottom. The space left is filled up with a perforated slab of slate or zinc. Into the division or compartment thus formed at one end of the tank the water is poured by the inlet pipe *d*, and passes through, first, a layer of large-sized gravel or broken bricks *e*; second, a layer *f* of wool and animal charcoal, mixed; and, third, a layer of sharp clean river sand *g*; and, finally, passed through the grating *c* to the main body of the tank *h*, from which it is pumped. In fig. 7

Fig. 6.

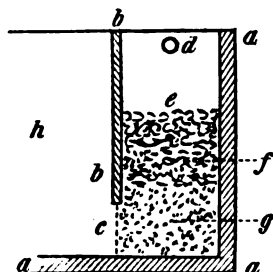
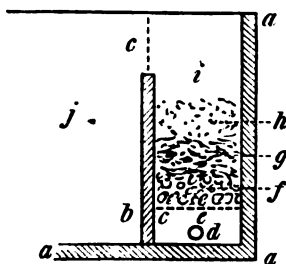


Fig. 7.



we illustrate the ascending system of filtration, in which *a a a* represents part of the tank; *b* the partition of stone secured to the bottom, but reaching only to the point shown in the drawing, the remaining space being filled up with a perforated slab *c*. The compartment thus provided at one end of the tank is furnished with a small compartment *d* at bottom, made by a perforated slab *e e*. The water, passing from the inlet pipe *d*, ascends through *e e*, then through the layer *f* of gravel, next through the layer *g* of wool and charcoal; finally, through the layer of sand *h*, and passes off from *i* through *c* to the main body of the tank *j*.

AGRICULTURAL EDUCATION IN RURAL SCHOOLS.

No. I.

A FEW PLAIN REASONS FOR AFFORDING ELEMENTARY AGRICULTURAL INSTRUCTION IN RURAL SCHOOLS.

It may be safely assumed that there are few men whose opinion is entitled to respect, who are not in favour of introducing into the curriculum of common school instruction those varied and useful subjects nowadays embraced in the comprehensive phrase "common things," with the view of bringing knowledge to bear on the thoughts and occupations of the people. In a country like this, whose prosperity so largely depends on agricultural industry, the facts and phenomena of the field and farm-steading are the most common, as they are the most useful, things on which to enlighten and instruct them. It is far from my wish to propound the notion that the business of farming can be learned in the school-room; but it is my conviction and my anxious desire to prove that, even without school-farms, or any expensive appliances, the rural schools of the country can and ought to be made more useful than they have hitherto been, in promoting those habits of mind on which the best interests of individuals rest, and in fostering those industrial habits which promote the material prosperity alike of individuals and the State. In order to establish these propositions it is only necessary to advert to the truisms, that all well-directed education tends to discipline the faculties of the mind, and that knowledge gives to the individual increased power of accomplishing certain ends with the means at his disposal. Now, surely these truisms apply to the agricultural classes as well as to any other. By imparting to the future farmer a knowledge of the fundamental principles of agriculture at that time of life when his mind is most susceptible of receiving lasting impressions, you lead him to perceive the link that connects effects with their causes, and to see the why and the wherefore of the practices of the skilled and successful farmer. In this way you discipline the mind of the future man, you elevate his thoughts, and increase his power of utilising every object with which he has to deal.

Again, if it be right to impart a knowledge of common things to the artisan classes, the circumstances of the working farmer and farm-labourer render this right more urgent. The artisan class dwell chiefly in towns, and enjoy various ways of acquiring knowledge in adult age. The agricultural classes, on the other hand, are isolated, and have not, if ever so eager for it, the same opportunity of self-education. The farmer in easy circumstances may, to a certain extent, make up for the want of early instruction in scientific agriculture by reading; but it cannot be expected that the working

farmer or labourer will, after a long day's hard work, seek entertainment in reading a treatise on agricultural chemistry, of which he knows nothing. The result is, if we do not impart to him in youth some knowledge of the science of the things which form the objects of his daily occupations, he will end his days ignorant of the laws which might have afforded him pleasure and profit, and by the application of which he might have been enabled to advance himself and his offspring in the social scale.

If I am called upon to afford plain unvarnished proof in support of the view here expressed, it is only necessary to refer to the past and present state of agriculture in Ireland. It is needless to argue that our practices are defective. Weeds occupy the ground, and absorb from the land the nutriments that ought to be producing corn and beef. The rush and snipe, and worthless or indifferent pasture, occupy the soil that ought to be yielding turnips and bread-stuffs; our clays are wet, cold, and unproductive; the constituents of our manure-heaps, the renovators of worn-out land, are allowed to run waste in every streamlet; we suffer a loss of millions sterling in the management of one crop; and it admits of easy demonstration, that if a rational system of farming was universally followed on the broad acres of the country, the national produce would be enhanced by many millions sterling. I speak on this point not without experience. I have sprung from a race of farmers; and I say, without fear of outstripping the bounds of sober reality, that the radical defects in our farming—those which prevailed in the land of my own birth and education—could be prevented by early instruction in the rudiments of agricultural science. There are other causes at work in every country that check, more or less, the spread of sound agricultural practices. The want of knowledge has not been the only cause that has retarded agricultural progress in these islands. Still, we have suffered from the want of knowledge. The working farmers and farm-labourers have not been deficient in skill in the performance of the mechanical operations of ploughing and digging, sowing and reaping, but they have been deficient in that higher skill—that power which knowledge gives of obtaining from the land the largest produce at the smallest cost, and of converting the produce so obtained to the fullest account.

Another argument in favour of introducing agriculture as an element of instruction in rural schools is presented in the circumstance, that of all the industrial pursuits of the humbler classes there is none, perhaps, whose fundamental truths can be so well explained in our primary schools as agriculture. Perhaps the best way of supporting this statement is by a couple of examples. One of the cardinal maxims in modern farming is, that the land intended for the staple green crops should be tilled as early as possible. The *rationale* of this practice, which can be easily communi-

cated to boys, and which gives the key to the entire theory of cultivation, is, that we produce in the soil food for the crop—that tillage is, to a certain extent, a substitute for manure. There are certain advantages in applying manure at the same season; and science has shown that this practice of autumn manuring may be more safely followed on clays than on light land—that the former have greater power than the latter of absorbing and retaining the most important constituents of the decomposing manure. To a well-informed teacher these are all simple matters, but they are of great practical importance.

Passing over the innumerable subjects that might be adduced as examples, such as the rotation of crops, farmyard manure, the hay crop, &c., I take my second illustration from the management of live stock. The leading principles of animal nutrition—those broad though elementary principles which would enable the farmer to avoid the many errors he commits in cattle-feeding—can be easily imparted in a few simple lessons. Some of the principles involved in the improvement of the breeds of cattle can also be explained with great ease. This kind of knowledge possesses the additional advantage that much of it is of direct use, and applicable to man himself. The great principles of nutrition are the same in man and the domestic animals; and physical existence in both cases is governed by the same laws.

It is needless to multiply instances. It is enough that it admits of demonstration that the fundamental scientific truths, by which an enlightened system of farming should be guided, admit of being taught in the primary schools of the country, and that it would be difficult to point out any other pursuit in which you could find better illustrations of the power which knowledge gives than those which I have selected in the case of agriculture.

It follows, then, that supposing the agriculture of this country were perfect—if many of our practices were exempt from the blunders which at present prevail—the agricultural classes should be taught, in the primary schools, the elementary principles of their art. And surely, if it be politic to teach the principles of mining and of navigation, and of art and music, in our national schools, it is not less useful or necessary to teach the elements of agriculture.*

* This idea is happily expressed in the following passage from the pen of a good and gifted man :—"But surely, if all other industrial instruction ought to be excluded from the province of State interference, an exception ought to be made, as has been done by the Irish National Board, in favour of the two employments which are not to be regarded so much as trades, but as the nearly universal occupation of the two sexes throughout the poor population of Ireland—the use of the spade by the males, and the use of the needle by the females. If there be any truth in the reasonings of those who would, upon principle, exclude agricultural education from the elementary education of boys in our national schools, we ought, on the same grounds, to exclude sewing from the elementary education of the girls—than which, surely, nothing more absurd can be imagined."

A strong argument in favour of introducing agriculture as an element into the instruction of all classes of farmers is, that it gives them a taste for reading agricultural books and agricultural journals. It is not too much to say that, in the race of contemporary progress in science and the arts during the past twenty-five years, there is no parallel for the strides made by agriculture. Its literature has assumed the character of the literature of any of the professions. The Transactions of the Highland Society and of the Royal Agricultural Society of England will bear favourable comparison with the Transactions of any of the learned societies. The standard weeklies, too, record the result of some discovery in science, or some results achieved by practical men. These discoveries and results cannot be communicated in language entirely free from technical terms. The standard literature of agriculture is, therefore, too frequently sealed from many practical men who might have benefited by it, if the elements of agricultural science had been embraced in their education.

I am not ignorant of the fact that there are farmers who decry the agricultural knowledge contained in books and journals, and that there is even an apparent antagonism between so-called practical and scientific men. This antagonism either is the result of a misconception of terms, or springs from narrow views. Every truly scientific agriculturist should collect his facts from the well-attested experience of practical men. And every intelligent practical man is daily observing facts which, if methodised and compared with the facts of other farmers, would become science. Some of the men who have engaged in investigating the science of agriculture, have not always collected their facts with due care; and, as might have been expected, their theories have been crude, and their conclusions at variance with real experience. A few examples of this kind might be quoted, which have given shrewd practical men a distaste for all scientific or book learning, as they call it, and a distrust of the advice of all scientific men. But if we study the history of arts and sciences, we shall find that they have all had vagaries of this kind to contend against; and yet no one doubts the value of book-learning to the engineer, medical man, &c. If the reading of agricultural books and the acquisition of a little knowledge of the principles of agriculture had the effect of making a farmer less skilful or practical, I, for my part, would join in the cry against them. But knowing as I do something of the science and practice of agriculture, I am bound to say I see no antagonism between them. What I contend for is, not to make practical men less practical, but to make them more conversant with their business. I repudiate the notion that the farmer who reads a few standard agricultural works, or a standard agricultural journal, is a less practical man than he who is ignorant of all science, and despises all books and journals. Such a notion should receive no encouragement in this age, when such men as Mr Henry Stephens, Mr Wilson of Eddington Mains, and Mr John

Chalmers Morton, write agricultural treatises ; when such men as Mr Russell of Pilmuir edit the Transactions of agricultural societies ; when the Hopes and Cairds read papers at agricultural meetings ; when, in fact, the difference between the reading and non-reading farmer is a difference between the individual judgment and experience of one man, and the accumulated wisdom and experience of a host of able and experienced men.

A motive equally urgent for affording the future agricultural labourers a knowledge of the elementary principles of agriculture, as well as increasing their skill by early agricultural training, is also presented in the recent improvements in the implements and machines of husbandry, and the increased necessity that has arisen for them in consequence of the diminished supply of agricultural labour. This is not the place to discuss the economy of improved agricultural machinery, nor to show how, by saving labour, machinery creates labour. We have the plain fact before us, that the farmers find it their interest to buy steam-engines, mowing and reaping machines, and a great variety of other instruments for economising labour. Now, it is often found that these machines, which are always economical in the hands of intelligent and skilled labourers, prove the very opposite in the hands of ignorant men. Many of these implements and machines are costly, and necessarily complicated in construction. The simplest implement or machine in use involves some mechanical principles, a knowledge of which is conducive to its skilful use, and, it may be, its preservation. It is surely unwise to put a steam-engine, thrashing-machine, or reaping-machine, into the hands of a man entirely ignorant of the strength of material, or the properties of steam or a lever. The ploughman who is utterly ignorant of the principles involved in draught, cannot be expected to get through his work with the least strain upon the horses. Over and over again I have come across farmers who purchased machines, which, if properly used, would have proved economical, but which were thrown aside as useless for want of knowledge on the part of master and man. In all these cases, the money sunk in the machines was regarded as a bad investment ; the economy or profit which would have arisen from their use was lost, and agricultural progress retarded. The complaint is now pretty general that tillage does not pay, and the causes assigned are low prices and the advancing rate of wages. Assuming that corn remains at its present price, our chief hope of increasing the profits on cereal and other crop cultivation is in the use of a good class of implements and machines, which would cheapen the cost of production. This object cannot be accomplished in accordance with the wants of the times, unless we increase the knowledge and skill of the men who are to work these implements and machines. Now it must be evident that, in order to impart the necessary knowledge, we must begin in the primary schools of the country ; for my own part, I see no other way in which it can be acquired.

From a pretty lengthened correspondence with extensive employers of labour, as well as with men who view this subject from a philosophic point of view, and from my own independent observation, I am justified in saying that the labourer who understands something of the principles of the implements he uses, takes a deeper interest in his work. He performs the work allotted to him with more satisfaction to himself, and with more profit to his employer. Regarding the matter from this point of view, I consider that the employers of agricultural labour are most deeply interested in the agricultural instruction of the rising generation of labourers. The same view was well expressed some time ago by Mr Robert Scott Burn, the well-known agricultural writer, in a paper which he read before the London Farmers' Club. "Knowledge," says the writer, "gives a man a quickening interest in the processes in which he is engaged, and an interested man will make a better servant than an indifferent one. In proportion as we find a man elevated in his ideas, just in proportion are his services rendered of the highest value. We find this to hold true in other callings; why should it not in that of agriculture?"

I should hope that the foregoing reasons leave no room for doubting the propriety of introducing agriculture as an element in all rural schools. To do so effectually, you must begin by giving the teacher an interest in the subject. You must (1) include agriculture in the programme of examination for his classification and promotion; and (2) make some small increase to his income for teaching the special branch. You would also require a few agricultural textbooks, such as those prepared for the Irish National Schools, or Mr Stephens's 'Catechism of Practical Agriculture'*—elementary ones for the boys, and one that would, in a small compass, give the pith and marrow of modern agriculture, for the teachers. By the use of these text-books in the rural schools of the country, you would bring home to the people a large amount of useful information which cannot otherwise reach them.

I have endeavoured to show that the progressive character of agriculture, and the transition state of the labour market, render it imperative upon us to instruct the rising generation of farmers and labourers in the elementary principles of their business. And if it be desirable to do this in parts of the empire well or fairly managed,

* "By means of a course of agricultural tuition in the schools," says Mr Stephens in his Catechism, "as exemplified on the neighbouring farms, a large amount of correct agricultural knowledge would be imparted to young boys and girls destined to earn their livelihood on farms, and which at present is only obtainable by labour in the fields, to the serious neglect of other kinds of knowledge only to be acquired at school. Drawings of the cultivated plants in their different states of growth, and of the varieties of stock usually reared, might be placed before pupils with much advantage. Samples, too, of the various grasses and seeds sown on farms, would at once impress upon the memory of pupils their identity and use."

the necessity of diffusing this kind of knowledge among the small farmers and labourers of most parts of Ireland becomes very urgent indeed. I have of late examined several districts in Ireland, and notwithstanding our boasted progress, the people are deplorably deficient in that elementary knowledge which I have been advocating. I have been over small farms whose occupants depend principally on oats and potatoes. They do not adopt a rotation of crops of any kind, and are too frequently ignorant of its advantages. While they merely make out an existence with their present mode of management, they would become prosperous and happy, and continue to give strength to the arm of the empire, if they understood and practised a good system of cropping and farm management. As they employ no labour, the rate of wages cannot directly affect them; and as the land does not yield more than half a crop, their depressed condition arises more from want of knowledge than low prices or bad seasons. Let me conclude by expressing a hope that the Government will aid in imparting this much-needed knowledge in all the rural national schools of Ireland, more especially those in the backward districts.

J. B., Gn.

THE FARMERS' NOTE-BOOK.—No. LXXXII.

*On the Turkey.**—This beautiful bird, a native of the United States, whence it extends through Canada and as far as Mexico, appears to have been imported into Spain very soon after the discovery of America. From Spain it was carried in 1524 to England, and shortly afterwards to France; then from France to Germany, where it retains the name of the French Fowl; and thence by degrees to all parts of the world, even to New Holland.

Needing air and exercise, solely sought for on account of its flesh, the turkey, removed from poultry-yards, where its keep is too costly, has remained the bird of the peasantry, who feed it on grass, and can thus supply it at a low price to the inhabitants of towns, with whom it is deservedly a favourite roast.

The flesh of the wild turkey is harder, and its plumage is more brilliant, than that of the tame turkey, the colours of which vary much. There are black, black and white, copper-coloured, and slate-coloured; these last are the rarest of all. I saw superb specimens this year in the park *Tête d'Or* at Lyons. We remember that at the last Exhibition at Paris its able Director, M. Gérard, got a prize for a slate-coloured turkey weighing above forty-three pounds.

* By M. LE DOCTEUR SACC, Delegate of the Imperial Society of Acclimatisation. Barcelona—(Translated).

Temminck, in his beautiful work on the 'Gallinaceae,' relates that he had seen in Leyden, at the house of Mrs Baker, a flock of copper-coloured turkeys with white crests, with the beauty of which he was enraptured. This fact is confirmed by several authors. In this, however, there is nothing extraordinary, as we have crested varieties in almost all our domestic fowls. Unhappily, that of the turkey is lost, and we have not found it again anywhere.

Made for walking, the turkey almost always remains on the ground, and only perches in the evening. Its senses are highly developed, especially that of sight, which enables it to perceive at a distance birds of prey, and to warn by its cries the other inhabitants of the poultry-yard. Very bold, the turkey does not hesitate to lead in attacking the robbers; and thus all poultry-yards having turkeys are safe from birds of prey. Often, in our fields at Neuchâtel, have I seen my turkeys attack and beat them off. Once only a turkey-hen gave up the combat, but she had to deal with one of the largest goshawks I ever saw; and yet she fought with him so long as to give me time to go for my gun and get rid of the ravisher.

In the open country, turkeys are quiet, gentle, and sociable; whereas shut up in a limited space they constantly fight, and often end in killing each other. This alone should cause their removal from poultry-yards, if their prodigious appetite did not render their presence there ruinous to the owner. Besides, the enormous gizzard of the turkey indicates its need of bulky and very nutritious aliments. This bird is in fact wholly herbivorous, and renders to dry countries the same services which the goose renders to inundated meadows. It grows rapidly, and furnishes abundantly a white and very delicate flesh.

The cocks are good only till three years old, because they then become too heavy and mischievous: the hens are at their best up to six years old. They lay twice in the year—the first laying, in April, of from fifteen to twenty eggs; the second in August, of, in general, from seven to ten eggs. The eggs, very conical, are generally white, with spots varying in size and redness according to the depth of colour in the plumage. I have had eggs of black turkeys completely red, and others of white turkeys perfectly white. Generally they are whitish-red, with spots of deep rose. The shell is thick, especially at the smaller end, which is covered with marked circular wrinkles. Turkey hens are commonly considered bad layers, but this opinion originates in imperfect observations; for my mother, who took the greatest care of her poultry-yard, having assured me that black-and-white turkeys were good layers, I wished to verify the fact, and was able to convince myself that while black-and-white turkeys laid hardly more than twenty eggs in the year, grey turkeys laid forty-two in the same space of time. This unexpected fact has induced me to draw up this notice, the essential aim of which is to induce fanciers of the larger poultry first to seek for, and then keep

separate and multiply, the species of good-laying turkeys, which would be a valuable acquisition to our peasantry. The laying is generally every second day. It is only towards the last, or when it is very hot and they are very well fed, that the birds lay every day.

Though all turkeys be good sitters, we prefer those of two years to those of one year ; and we give each of them fifteen to twenty eggs. It is indispensable to give the birds their own eggs, which are then almost all hatched ; whereas, if we give them those of several birds, we cannot count on succeeding with more than half, or at most two-thirds, of the eggs.

For the hatching, we arrange willow baskets, the bottoms of which are covered with straw, moss, or heath, on which we lay a bed of hay carefully crushed, so that the nest shall not be too deep, which exposes the eggs to the risk of being broken by rolling against each other, and hinders the bird from warming them equally. Alongside of the baskets we place within reach of the hatchers two troughs, the one full of oats, the other of water, and every twenty-four hours we lift the turkey off her eggs that she may relieve herself, and roll in the dust to get rid of the lice which swarm on the poor sitters. In five or six minutes the indefatigable sitter returns to her eggs, which, according to the surrounding temperature, are hatched from the 27th to the 30th day. I have always seen them hatched in the course of the 28th, because I kept my hatchers in a garret very warm and dry. This hatching place is in general much the best in our temperate and humid regions ; but when the summer is scorching it dries the eggs too much, and causes the chicks to remain glued to the shell ; an inconvenience to be obviated by slightly sprinkling the eggs with water whenever the turkey leaves the nest. The hatching place should be sheltered from draughts, from noise, and direct and powerful light.

As soon as the chicks appear, the fowls are no longer touched ; but, twenty-four hours after, we place alongside of the basket a flat nest, made of some handfuls of very fine hay, on which we set the mother, losing no time in giving her her chicks, which one after the other are slipped under her.

During the first eight days, the little ones are fed on eggs boiled hard and minced ; during the second, we add to this bread-crumbs chopped with nettles, parsley, and onions. During the third week we keep back the eggs, and only continue the bread and the vegetables ; then instead of the bread we give moistened bran, boiled pease, and, above all, millet, of which young turkeys are very fond.

When these birds are sickly, they are easily cured by making them swallow a pepper-corn, or, better still, a spider ; their bills being carefully opened to avoid hurting them.

Some authors advise the letting-out of these birds when the weather is fine ; but when following this advice, I have lost so many

that I have given it up altogether. I have since left them in their garrets till they had put forth the red, which occurs in from six weeks to two months, taking care to give them as much air as possible; and from that time I have not lost one. During the crisis of putting forth the red—that is, the red protuberances of the head and neck—we again give the little turkeys stimulating food, consisting of bread minced with onions and nettles or parsley. When this is past, the turkeys are as robust as previously they were delicate, and stand all weather: now is the time to let them out to the open country, where they feed themselves on all sorts of herbs and insects, of which they are so fond that in Switzerland they are made to follow the plough for the purpose of destroying the turned-up larvæ of cockchafers.

Though turkeys can easily endure the severest winter in the open air, it is good at that season to bring them back to the poultry-house, because they eat less.

In order to fatten them, we have only to shut them up in a court for two or three weeks, feeding them on bran soaked in water, boiled potatoes, and maize, and avoiding to give them oleaginous seeds, because these communicate their oily flavour to the flesh of the birds. But rotten cheese, cooked or uncooked, is excellent food for them; specially such are carrots, and also spoiled fruits, which they swallow whole, as well as walnuts. It is singular that all turkeys are not fond of walnuts, but that those which are, fatten most readily. I have had frequent experience: at first they only take them hesitatingly, but when they know them, they seek for them again greedily. These fruits, however hard their shells, soften rapidly in the gizzard, in which not a trace of them can be found after fifteen or twenty minutes. In a chemical point of view, this speedy disintegration of one of the hardest and most compact of woody substances is equally strange and inexplicable.—(*Read at the Imperial Society of Acclimatisation, 20th October 1863*).

There are several points in this notice deserving of attention. The size of the prize bird exhibited at Paris, and weighing above 43 lb., is such as to indicate very skilful rearing; seeing that Martin (in 'The Poultry Yard,' Routledge, 1858) makes this statement, "Turkeys of 25 and 30 lb. are rare; yet instances have been known in which prize birds have weighed nearly 35."

The rearing of turkeys in garrets may appear something novel, but a pen of Brahmapootra chickens, which figured in several prize-lists, was hatched and reared at the top of a house in Tottenham-court Road, London. The keeping of them in confinement till the sexual distinctions are manifested, by the appearing of the carunculated skin round the neck and throat, seems to be a measure of undoubted utility, though by no means commonly adopted in this country. And as Dr Sacc is so positive as to the superior laying

powers of the grey turkey, our "henwives" should part with their prepossessions in favour of black-and-white turkeys. Doing this, we shall pardon their mirthful incredulity when gravely invited to have implicit confidence in the administration of a *spider* to a sick turkey.

*The Influence of Localities on Wool.**—The development of organised beings, Cuvier has said, is more or less rapid and extensive according as circumstances are more or less favourable. Heat, quantity and quality of food, in addition to other circumstances, influence it, and this influence may be general over the whole body, or partial over certain organs.

Of all agricultural products, wool is assuredly one of those which with the greatest constancy submit to the influence of localities; and perhaps it will not appear useless, especially from an acclimatisation point of view, to make known the results due to this influence.

Amongst domestic animals, the sheep species is conspicuous in the number of those which can live under the most different climates. In the moist pastures of Holland, as well as in the arid plains of lousy Champagne, in Africa or Russia, everywhere it lives, as if Providence had wished the universal diffusion of an animal whose fleece is in some sort indispensable to man.

We may lay it down as a principle, that wherever the land is good, there the wool is equally so. If of medium quality, the wool loses in quality and value. If sandy and poor, it becomes poor, short in the lock, harsh and brittle.

Merinos perfectly similar and well formed, if transported to a country different from that of their origin—for instance, from la Brie to Gâtinais—in spite of care and of abundant food, but whose principles have been changed by the soil, will at the end of a few years have wool which has become like that of the merinos of the country; for this reason, equally recognised by science and practice, that the organism necessarily adapts itself to the conditions under which individuals live. Thus the type can be maintained only by constant renewal of the stock, which, regarded from a rural-economy point of view, is generally a bad proceeding; for experience teaches that, to be profitable, agricultural industry should always seek to produce animals in relation to the locality where it operates.

In the same department, with a like species, the nature of the wool so changes that an experienced eye can, with unvarying acuteness, declare from what locality it comes. In a general point of view, it may be asserted that the better the land, and the better cultivated, the better the wool.

Let us take *Seine-et-Marne* for an example.

The wool of this fertile country is almost wholly produced from

* By M. Teyssier des Farges—(Translated).

merinos of medium fineness; celebrated for its strength, its elasticity, and the length of the lock, it differs according to localities. Thus, an excellent wool is produced in *le Multieu*, which is called the *clos vougeot de la Brie*, and of which Arthur Young declared that if God had willed to place anywhere an agricultural paradise, He would have selected *le Multieu*. The whole of the country round Lieusaint, as far as Mormant, so remarkable for its fine tillage and the goodness of the soil, produces a wool nearly equal to the preceding. Around De Rosay and De Nangis, the wool, still very good, is not so strong. Towards Provins, where the soil is more calcareous, and De Montereau, where it is not so good, it is harder. If we enter Le Gàtinais we find it shorter in the lock, drier, harsher, in precise relation to the soil, and consequently to the food.

The wools of Spain are generally very coarse; they make a tissue hardly usable, very thick, very strong, but lacking the elasticity, the softness, the silkiness, so desiderated nowadays, and which above all are supplied by the wools of Germany and Australia. Formerly pre-eminent, they are not so fine as formerly, and they are hardly employed unless mixed. This difference in fineness is owing to the Spaniards not bestowing on their flocks the same pains as formerly, and to negligence in the selection of breeders. As to their nature, it should be ascribed to the strong herbage on which the Spanish sheep feed, and to their way of living. Indeed, generally exposed to the air, to the night moisture, to the sun, and the dust, and accustomed to lie on the ground, they lead a very rustic life. These conditions produce those wools so remarkable for their coarseness. We add, that the antiquity of the blood must also exert its share of influence.

In Russia, on the contrary, where the cold during a great part of the year is extreme, the sheep live mostly in folds. They thus lose the vigour brought about by a more temperate climate, and by the different management which it allows. On the other hand, the shearing is before the hot weather, which, moreover, is of short duration, so that the wool does not come under its influence. Thus, the merino wools of Russia have much softness, with the merit of yielding a white open lock, but their defect is largeness of grain.

In the same empire, in Tauris, where the climate is quite different, the wools are harsh, hard, and dry.

German wools, especially the beautiful wools of the Electorate of Saxony, which are now the first in the world in respect to beauty, fineness, and silkiness, owe their qualities to very careful selection, management suited to the end proposed, good pasturages, and a temperate climate, rather cold than hot.

The wools of Australia, in a locality quite different from Russia, are equally pliable and soft. One would think that the flocks living in the open air should, like those of Spain, produce a coarse wool. This seeming contradiction is explained by the difference of food.

Living in steppes where the pastures, more or less abundant, more or less nutritive, are often burnt up by drought, the flocks, which do not receive strengthening food in folds, are not in a natural state of health, and their fleeces feel the effect of this. There are exceptions, especially in those from Port-Philip, but it is probable that this difference in quality is owing to better food. Cloths made from the wools of Australia look well and handle well, but they want strength, and do not last.

We cannot insist too much on the influence of food. The merinos, which consume much pulp, produce a wool little suited for the manufacture of glossy cloths. The interior of the hair is not equally filled with that essential oil which imparts elasticity and softness. Glossy stuff made of this large-grained wool crimps in the dressing, and does not allow the hair, detached from the thread by the teasel, to lie flat so as to form a soft down. This inconvenience no longer exists in regard to novelties or combed stuff, because cloths of these sorts are either napless or curled, and have no down.

It cannot be doubted that too watery food must singularly affect the nature of the wool, because it excites an evident disturbance in the general economy; it develops an excess of the lymphatic element, makes the wool degenerate, and renders the wool soft, poor, and without substance.

Beetroot not distilled, given in moderation, does not appear to produce such an action. It is even beneficial, specially because it keeps the digestive organs in a natural condition, and hinders the inflammatory diseases so common among sheep.

Do we wish another example of the influence of food? Everybody knows that when the end of winter comes, and forage is scarce, the sheep are not sufficiently fed. Independent of the inconveniences arising from this bad management, it is of consequence to observe its influence on the fleeces. If, in like circumstances, we take a lock of wool, it is easy to see differences in size and shading, according to the time at which the animal has been well or ill fed. Of a whitish blue when suffering, it becomes a milky yellow when better fed; and the hair, submitted to a certain degree of tension, never fails to break at the place where the connection begins at the transition from bad to good feeding.

We agree with M. Bella when stating that only high farming can produce the heaviest fleeces, as well as the most equal, the longest and strongest wool, because it alone can supply the attention, food, and shelter necessary for the attainment of such results. We more naturally, and consequently more cheaply, obtain wool of medium fineness, like ours, so well known under the name of French Merinos. This is one of the reasons which explain why countries whose agriculture is advanced give up producing very fine wool in order to keep to that of medium fineness and, speaking of this, we remark

that Germany itself tends to enter on the road which we now follow in France.

The merino does not thrive in foggy or rainy countries like England. It is often said that this is owing to its constitution being more delicate than that of other breeds. This is a grave error, contradicted by many facts, each more demonstrative than the other. According to us, two principal causes explain this difficulty of rearing the merino under a rainy climate—namely, the closeness of the fleece, and the many roughnesses with which every lock of the wool bristles. This closeness and these roughnesses retain water longer and in greater quantity than other wools. If the rains be frequent and the climate foggy, the constant moistness of the wool, which is intended for the animal's protection, hurts it, on the contrary; the action of the skin is no longer in all its strength. This essential function of the organism being impeded, the animal is in a state of constant suffering, and consequently subject to numerous diseases, particularly the rot, or aqueous cachexy, the progress of which is the more active, as the food in these same climates has a singular tendency to produce lymph.

We do not think that sheep habitually exposed to heavy rains are soon covered with uneven hair, and the proof is that in warm countries like Africa we often meet with it, whereas we do not see it in the few merinos still left in England. In our opinion this serious inconvenience is rather owing to privations and bad feeding. We might multiply examples. Those which we have recalled are, we think, enough to explain that the influence of localities, and especially of food, is manifestly the cause of the modifications which wool undergoes.

In practical agriculture we do not always sufficiently think of this influence. Nevertheless it is with good reason that the lamented Isidore Geoffrey Saint Hilaire has said, "What is agriculture but the scientific knowledge of things which modify, and the art of applying their action according to the results to be obtained?"—(*Read before the Imperial Acclimatisation Society, Paris, 20th May 1863.*)

(*Note.*—Believing that they will be interesting to our readers, similar translations will occasionally appear in this Journal.)

Experiments with Coprolites, &c.—Some years ago the notion was generally entertained that coprolites possessed no fertilising powers until acted on by sulphuric or some other acid. A chemist, whose name is prominently before the public, gave expression to the opinion that they possessed no more value than the same weight of sand. The writer of this communication was the first who instituted experiments for the purpose of testing this opinion. In these experiments it was found that coprolites afforded nourishment to the green crops to which they were applied. Others have veri-

fied my conclusions; and I now submit another series, which now appears to me to possess interest.

In 1863 I was enabled to carry out a set of experiments, having for their object the elucidation of the action of phosphates of lime, and the state in which they could be most profitably applied on a good loamy soil. For this purpose, seven quarter-acre plots were set apart in a field pretty well adapted for experiments. In this communication I need not detail the results shown in all the plots. It is enough to notice the following:—

Plot I. One rood, or 40 perches,—

a 20 perches, or $\frac{1}{2}$ of an acre, received no manure.

b 20 perches, was manured with 2 cwt. common salt, which cost about 7d. a cwt.

„ II. One rood, or 40 perches, 4 cwt. 2 st. ground coprolites; cost, 14s.

„ III. One rood, or 40 perches, $3\frac{1}{2}$ cwt. ground coprolites, and 4 cwt. common salt; cost, 14s.

The ground was treated in autumn and spring as it is generally prepared for swedes on this farm. The seed (Skirving's Swede) was sown on the 30th May 1863, the manure having been carefully deposited by hand after the double mould-board plough had split every alternate drill; it was fully covered in by the same implement going through the remaining drills.

The after-cultivation of the crop was attended to pretty well. The crop was lifted in December, and stored by placing the plants closely together, with the tops on, in separate lots on a piece of clean short grass. They were topped carefully in March 1864 (when they were all in good condition), and the bulbs weighed as follows:—

Plot.	Manure.	Weight of Bulbs.					
		Per Plot.			Per S. Acre.		
		ton.	cwt.	st.	ton.	cwt.	st.
I. a 20 perches.	No manure.	1	11	0	12	8	0
b Do.	Common salt.	1	12	7	13	3	0
II. 40 perches.	Ground coprolites.	3	10	$6\frac{1}{2}$	14	3	2
III. Do.	Ground coprolites and common salt.	3	13	$6\frac{1}{2}$	14	14	3

The total produce of each plot was weighed in this case; and I may here observe that I have little faith at all in the result of experiments when the yield per acre is *calculated* from the produce of a few yards of a drill.

This experiment, and others which I conducted, assign a positive manurial value to ground coprolites. We have yet, however, to learn how the farmer can take profitable advantage of this fact. In 1863, the increased produce obtained by the use of coprolites did not equal the cost of the manure. In this respect, however, the coprolites are not singular, Lawes's superphosphate, Peruvian guano, &c.,

having in this experiment failed to give an increase of crop equal to the cost of the manure applied.

The experiment also supports the popular belief as to the fertilising properties of common salt. That common salt is capable of acting as a manure I never doubted; and my object in using it alone was to test its effects when used in conjunction with coprolites. Mr Lawes has recently expressed strong doubts as to the fertilising power of this substance; and no doubt he had good reasons for the opinion he propounded. My experiment shows that common salt did actually increase the produce; and the cases are innumerable in which it produced far more favourable results.*

My great object in using common salt in this experiment was to see if it could be successfully employed in promoting the solubility of the ground coprolites. The usual method of making the phosphate of lime in coprolites more active, or available for crops, is by dissolving them in sulphuric acid; but everybody knows that this process increases the price which the farmer pays for the phosphate from £5 or £6 to £30 and upwards per ton. It is universally admitted, that when the biphosphate produced is put on the land, it is reconverted into insoluble or neutral phosphate. The real advantage, then, which is supposed to arise from the conversion of the phosphate of lime in bones, coprolites, &c., into biphosphate is, that in the reconversion of the biphosphate into neutral phosphate in the soil it falls into particles so small that it is more easily dissolved.

I have, before now, thrown out the suggestion that this *ultimate* object of the manufacture of superphosphate is accomplished at a

* Dr Voelcker has also of late expressed himself unfavourably regarding the action of common salt as a manure. But the fact is, that his own experiments on the Royal Agricultural College farm, Cirencester, ascribe a high manurial value to this substance. In 1859 it was found that—

1. An unmanured plot produced per acre of wheat,	27 bushels.
2. Manured with 1½ cwt. nitrate of soda,	38 "
3. " 180 lb. do. and 1½ cwt. common salt,	40½ "

Again, on the same farm, the yield of wheat in 1860 was as follows:—

1. Unmanured,	34 bushels.
2. 3 cwt. common salt,	35½ "
3. 1½ cwt. nitrate of soda,	44 "
4. 1½ do. do. and 3 cwt. common salt,	47½ "

In 1861 the result stood thus:—

1. Unmanured,	31 bushels.
2. 3 cwt. common salt,	38 "
In 1862, no manure, gave	29 "
" 3 cwt. salt,	38.75 "

In this year common salt did not, as in preceding years, increase the action of nitrate of soda. In 1863 the experiments appear to be contradictory; but we must not throw overboard the favourable results obtained for years, because in one year or two the returns appear contradictory.

cost to the farmer which does not always pay him. Of late years, some of the best farmers I know have been substituting Peruvian guano for superphosphate, less or more, even for roots. Now it is well known that by dissolving common salt, or any alkaline salt, in water, we increase the capacity of the liquid for dissolving phosphate of lime. I have endeavoured to reduce this well-known fact in science to practice. So far the result is encouraging. By substituting 4 cwt. common salt for the same money's worth of coprolites, I obtained an increase of 11 cwt. of roots per acre. *Vide* results on Plots II. and III.

In concluding this communication I may be permitted to offer a few words of advice (suggested by my own experience) to those who embark in experiments for the first time. First of all, I would observe that the common practice of determining the *acreable* yield from the produce of a few yards of a drill is highly objectionable, and should be discountenanced. A slight error in weighing the produce of a few square yards, when multiplied by the high factor used in working out the yield per acre, becomes so magnified and distorted that the conclusion is not to be trusted. I have had some striking instances of this in my own experience; one case will suffice here. In 1854 we tested several manures for growing swedes, and ascertained the *acreable* yield of the plots in two ways; 1st, by weighing the roots on a square perch and multiplying this by 160; and 2d, by weighing the total produce on the plots. Confining myself to two of the manures, I find the following results:—

I. *Acreable* yield of swedes when determined from the produce of one square perch—

cwt.		tons.	cwt.
5	Superphosphate,	39	7
10	Do.	36	5

II. *Acreable* yield of swedes on the same plots, when the total produce on the plots was weighed—

cwt.		tons.	cwt.
5	Superphosphate,	30	13
10	Do.,	34	0

Again, an experimenter should take every possible precaution that would guard himself and the public from the evils of erroneous conclusions. In the case of experiments with manures, the ground requires to be uniform in quality; all the plots should be tilled alike in every respect; the manures must be carefully and evenly distributed; the plants should be thinned to the same distance (and to this end a good dibbling machine is a valuable acquisition), and the total produce weighed. Hundreds of experiments published in the *Agricultural Journals*, and quoted over and over again, are valueless, or worse, because of the mode in which the *acreable* produce was determined; and I venture to say that a very large number are equally valueless for want of proper care in thinning the plants. I had ample proof of this in experiments which I conducted in 1863.

In these experiments Plot No. 6 was manured with crushed bones, Plot No. 7 with the same money's worth of a mixture of equal weights of Lawes's superphosphate and Peruvian guano. Now, had I published the weight of plants on those plots without having examined all the circumstances of the case, I would be promulgating error as others have inadvertently done before. Thus, in January '64, when these plots were weighed I found the following results:—

Plot.	Manure.	Yield of Bulbs and Tops per Statute Acre.		
		tons.	cwt.	stones.
6	Crushed Bones, . .	16	7	0
7	{ Half Peruvian Guano, . { Half Superphosphate, .	15	13	4

It so happened that, from one cause or another, the number of blanks arising from imperfect thinning, &c., in Plot 7 was so great that the number of plants in it was 6 per cent less than on Plot 6. This must have caused a deficiency in the yield on this plot which should not be ascribed to the manure. Increasing the produce on this plot by 6 per cent, we have the following results:—

Plot.	Manure.	Acreable Yield of Roots and Bulbs.		
		tons.	cwt.	stones.
6	Crushed Bones, . .	16	7	0
7	{ Half Guano, . . { Half Superphosphate, .	16	12	2

It may be objected that a calculation of this kind is scarcely admissible, inasmuch as the plants near the "blanks" grow larger than when no such blanks occur. I admit they are likely to grow to a larger size, and that the relative merits of the two manures, say in the above case, would lie between the figures in the two tables. The true result is, however, much nearer the amended than the original table.

T. B. GN.

AGRICULTURAL SUMMARY FOR THE QUARTER.

OCTOBER opened with beautiful weather, the sky being clear and the temperature mild. Indeed, it is rarely that such fine days are experienced at this season of the year as those we were blessed with in the beginning of the bygone quarter. There were some slight frosts at night, but nothing to injure vegetation, which suffered more from the drought. The dry weather continued up to the middle of October, and enabled farmers on the high and late districts to get in their corn in excellent condition—a feat they had not been able to accomplish for many years before. Potato-gathering was also vigorously proceeded with, and the crop in some of the earlier districts was secured almost without a shower of rain. On the 16th, however, there was a heavy fall of rain, on the 17th and 18th slight showers, and on the 19th a continuous and heavy fall; and in the end of the week there was a storm of wind and rain of almost unexampled violence, which filled all the rivers to overflowing, flooded fields, carried off much agricultural produce in certain places, threw down bridges, and otherwise wrought dreadful havoc on land and sea. November opened with finer weather; potato-lifting was resumed; ploughing operations were rapidly pushed forward; and the turnips and grass improved considerably under the influence of the rains and the genial (though perhaps a little unseasonable) weather which followed. In the second week of November a large breadth of ploughing was accomplished, and a considerable portion of autumn wheat committed to the earth under favourable conditions; and the frosts at night were not keen enough to retard the growth of vegetation. About the middle of the month there was a change in the weather, which, from being moist and warm, altered to cold and wet; but in the following week the weather was again favourable to the prosecution of the labours of the farm, and wheat-sowing was got well forward. The last week of the month was characterised by slight frosts in the morning and violent storms of wind and rain at nights, which put a stop to ploughing on clay-lands, and prevented turnips from being carted off soft soils. December opened genially, and permitted the sowing of a considerable quantity of what. Since that time the weather was mild, but with drizzly rains up to the middle of the month, which prevented ploughing and sowing; and farm-work in some districts is rather behind. During the 16th there was a change to severe cold, and on the 17th the hill-tops were mantled over with snow, and a slight coating fell on the evening of the 18th. During the quarter there has been no improvement in the corn-markets; indeed, prices have rather receded. On the other hand, the prices of stock, slightly on the decline at the date of our last Summary, have been rather enhanced, especially for good lots. Potatoes, strange to say, have not risen much in value, but there is a

better demand for them. Notwithstanding the low price of wheat, there is not, so far as we can learn, any great decrease (though there will be a little) in the breadth sown over the whole country. In particular districts some farmers have planted much less, while others have sown fully as much, if not more, than their usual quantity.

Discussions at Agricultural Clubs.—Agricultural associations have been very busy during the quarter. Their discussions, in a great many instances, have turned upon the management of stock, and how best to keep them on a short supply of roots. The general recommendation has been, to use the chaff-cutter and the turnip-pulper as much as possible in order to economise the roots, which in many parts of England have been a complete failure. The bruising of wheat, barley, &c., to mix along with the scanty succulent food, has also been largely recommended. Another fertile subject of discussion, arising out of the high price of beef, mutton, and wool, and the low price of cereal produce in the markets, was the desirability of turning arable land into permanent pasture, and the best and most profitable mode of doing this. As to the latter question, the answers are very conflicting—almost every one having his own specific as to the mode of sowing down, and the quantities and kinds of grass seeds to sow. Most farmers, however, seem agreed that a considerably larger breadth of grass might be laid down with safety and profit; but some very wisely caution agriculturists from going too far in this direction, which many seem but too likely to do, forgetful that green crops are necessary for cattle and sheep as well as pasture. The East Lothian Agricultural Club has had a very interesting discussion on "*Whether it would be expedient to increase the number of sheep in the county; and if so, what varieties it would be most profitable to cultivate?*" the unanimous resolution of the members, on the motion of Mr Hope, Fenton Barns, being—"That the Club is of opinion that the feeding of stock in the county may be still further increased; and that long-woolled sheep, particularly Leicesters, and crosses from them, have hitherto proved most remunerative." The Morayshire Farmers' Club has discussed at great length and with much interesting and instructive detail *the Growing of Turnips*; the Hexham Club has had before it *the Breeding and Management of Blackfaced Sheep*; the Newcastle Farmers' Club has discussed *the best Mode of Storing and Consuming Roots*; the Galashiels Farmers' Club has had under its consideration *the Possibility of increasing the Number of Sheep on Hill-pasture with Profit to the Farmer*, and has resolved that it is possible to so keep stock, on nineteen years' lease, by increased shelter, subdivision of the hills, and by draining and liming, where practicable, at a moderate expense; the Inverness Club has discussed *the Effect of the Importation of Foreign Cattle* in a somewhat desultory and rather unsatisfactory way; the Nairnshire Club arrived at no definite decision as to whether it would be advisable to *lay down more arable Land in Pasture*; and the Badenoch and Rothiemurchus Farming

Society came to the general conclusion that *it would be profitable for Sheep-farmers, holding an ordinary length of Lease, to Wire-fence and Surface-fence their Lands at their own Expense.* All these and other discussions will be found reported at length by those who are interested in them in the agricultural papers during the last quarter.

Some of the Causes that render Farming unprofitable.—This was the text for a recent lecture by Mr Mechi, the well-known agricultural Alderman, as he has been called, before the London Central Farmers' Club. Like most essays by the same gentleman, it was of a very discursive and rather disconnected character, and contained a great amount of good sense and sound information, along with that which was dubious in theory, and statements that require to be substantiated by wider experience before they can be made of general application. Whenever Mr Mechi succeeds in anything, he is too apt to think that it should be practicable to others irrespective of conditions. There is always an amount of sanguinity about him—his estimate of town sewage may be taken as an instance—which is perhaps accountable for in a youth beginning his farming career, but which one would hardly expect from one grown grey in agriculture. Mr Mechi started with the statement that

“ ‘Plenty of meat and manure’ must be, for the future, the motto of successful agriculture. The want of this is a prominent cause of unsuccess in farming. Farmers must learn to sell their crops to their animals rather than to the miller: even with an immediate loss of 15 per cent, there is a greater gain in so doing. If sending away the crops from the farm impoverishes it, keeping them at home must produce an opposite result; and therefore, if I want to know how a man is getting on, I ask him how many score pounds of meat per acre he makes over the whole area of his farm! 200 lb. per acre is a useful quantity.”

Now this may be all very good, but there are farmers who can show a tolerably good balance-sheet without making so much meat upon their farms as Mr Mechi here indicates. Their returns at the end of the year might indeed be better, considering the relative prices of corn and meat at present, if this amount were raised; but in order to grow so much meat, farmers need accommodation in the way of buildings and alteration in the modes of cropping which they have not got, and which their leases do not allow. Mr Mechi fortunately is his own landlord, and can build upon and do what he likes with his lands; as a tenant-farmer, with nothing but the produce of the soil to depend upon—no profitable business in town to draw upon in bad times—he might find much of his advice impracticable, and his alleged profits considerably reduced. Mr Mechi gives a list of some of the causes which render farming unprofitable. The length of his catalogue of ills is appalling, but in glancing over it, it is pleasant to find that many of them are perfectly trivial, and, still more, merely repetitive—the worthy Alderman, in drawing them up, having apparently forgotten that the greater includes the less. Among these evils Mr Mechi places in the forefront “unavoidable causes”—that is, losses through blight, mur-

rain, adverse seasons, &c. Now it may be mentioned that such contingencies are not peculiar to the farming interest; all occupations are subject to the same fate—the merchant to shipwrecks, fire, depression in trade, &c., &c.; and against such casualties the farmer has the same means of providing—viz, by insurance. It would have been much more profitable to the agricultural public if Mr Mechi had confined himself rigidly to the particular grievances farmers have to contend with, instead of rambling unrestrainedly, and somewhat tediously and uninformingly, over common ground. On the management of live stock, however, the owner of Tiptree Hall gives very good advice. He says:—

“I have written so much in my book” (throughout his lecture tit-bits of egotism of this kind are constantly cropping out) “upon this subject, and there is so little time here to treat upon the question, that I will dismiss it by saying that Alderman Mechi’s once-poohpooled notion about the chaffing and preparation of food is now becoming fashionable among practical agriculturists, who, I hope, will no longer compel their bullocks to drink, in the shape of 150 lb. of frozen turnips, 13½ gallons of frozen water, with only 15 lb. of dry but frozen matter. . . . I have generally been very successful in avoiding losses by stock; but this year I lost some calves merely by allowing them to eat their fill of rich sewage Italian rye-grass. Where they received only a moderate quantity of the same food they did well. Possibly, if they had received salt on the field they would not have suffered. Being convinced, by practical experience as well as by theory, that no farmer distant from a town can succeed well without plenty of live stock—that is, without producing plenty of meat and manure—I attach the utmost importance to the proper knowledge of stock-management, either by yourself or your stockman, or by both. I look upon this as a vital question as regards profit. . . . Mr — lost all his farm-horses by eating wheat from the barn-floor, the doors having been imperfectly closed. Other live stock suffer from the same cause. This dry season no end of sheep have died from ‘shacking,’ or eating dry barley on the stubbles. There was not enough green succulent food to mix with it, and they were allowed to fill their stomachs with the bare barley, which swelled when moistened by drinking. Farmer So-and-so lost several cows by turning them out to feed when the hoar-frost was on the leaves—icing their insides, in fact. Want of water has caused much loss by fever, &c. Whole fields of wet and frozen turnips fail to increase the weight of sheep, but, on the contrary, cause immense losses by death, especially among ewes and lambs. Some very fine-cut straw, with a proportion of corn and cake, would prevent all this. . . . If the loss of farm-horses by mismanagement could be statistically ascertained, it would form a sum of astounding magnitude, and show a great deduction from the farmer’s profits. Take, what is too often a common practice, as an example of mismanagement: horses in a state of perspiration after hard work are ridden into a cold horse-pond, or allowed to drink heartily of cold water, before they begin to feed: results—farcy, gripes, inflammation, &c. The London brewers’ horses drink when they please; but then a steam tube passes through the tank, and the water is always warm. We know what is the probable effect upon ourselves of drinking cold water when our bodies are overheated. Fat horses are, like fat men, unable to do a hard day’s work.”

With regard to ventilation, we cordially agree with Mr Mechi. It is in the highest degree necessary to the health of stock that a constant and sufficient supply of fresh air should be admitted to

byre or stable. His recommendation of the use of salt for live stock might also be acted upon with advantage by many.

"I hear," he remarks, "of so many cases where, by the use of salt, disease and non-success in stock have been remedied, that I consider its absence as very prejudicial. I have always had rock-salt in the mangers; common salt will do as well. Large losses in sheep often occur when being fed on rape or coleworts, especially after frost. This may be prevented by sowing over the leaves, in early morning, about two or three quarts of common salt, according to the size of the fold. I learned this from a large flock-master who had profited by the practice. Salt appears to prevent swelling or flatulence."

There is also much good sense in his advice to farmers coming from one locality to another—say from a humid climate to a dry one, or from a heavy clay soil to a light and sandy loam—to be cautious about changing the mode of culture which they find to be the custom of the district. We are sorry, however, that we cannot coincide with him in the belief that nothing is more easy than to get rid of wire-worm. Mr Mechi's specific against this pest is salting the land, or using about 5 cwt. of rape. Both remedies, and hosts of others, have been tried ineffectually in many districts of Scotland; and we doubt not, if Mr Mechi undertakes to slay them with either, that our farmers will allow him a handsome percentage for his trouble. Mr Mechi's statements about the ravages of game—ground game especially—are not overdrawn, and his suggestions that fields should be made larger than they often are, and that the land should not be starved, are good, but trite. In the discussion which followed the reading of this paper, Mr Walton of Chowton Park, Alton, laid great stress upon the want of security which farmers, in the absence of leases, had for a return of the capital which they laid out upon their land, a grievance happily not prevailing in Scotland. We are glad to see that the importance of a lengthened period of land-tenure as one of the greatest incentives to good farming is beginning to be recognised by English agriculturists. More and better buildings on farm-steadings for the accommodation of stock and implements, and a reduction of the amount of game, were other remedies which Mr Walton suggested for unprofitable farming. Mr Edmunds of Rugby declared the Alderman had told them nothing new. "He began with sewage, and he had ended with it, and the result was not yet satisfactory." This gentleman also considered the insecurity of tenure the greatest evil that farmers had to contend with. Dr Voelcker replied to Mr Mechi on the question of sewage, which he did not think at all likely to prove so profitable as that gentleman appeared to imagine. As this subject is exciting a very large amount of attention just now both in town and country, the remarks of this distinguished chemist cannot fail to be read with interest. He said:—

"No one could deny that an immense quantity of valuable fertilising matter was annually swept away and lost. The question was, how was that

valuable matter to be utilised? He (Dr Voelcker) would like to hear something tangible as to the manner in which that was to be done. They had been told that the time would probably come when the farmer would merely have to open the sewage-tap, just as the tap was now opened to let the gas out. But there was this important difference between gas and sewage, that if they opened the gas-tap they got a splendid light at a cheaper rate than oil, wax, or candles of any description could be supplied; whereas, if the sewage-tap were opened, it was very questionable what profit there would be. They might, indeed, get a very large profit; but, on the other hand, there might be nothing to pay for the outlay of the pipes. Now, that was a question upon which there was still required a great deal of information; it was a question which could not be settled in a general way. It was a question which depended especially on the character of the land. Whatever might be said about the wildness of the scheme of sending the metropolitan sewage down to Maplin Sands, at least this might be affirmed, that the land there was just the kind of land that was most likely to be benefited by sewage; for just in proportion as land was poor, and hardly capable of producing anything, was sewage likely to be good; and just in proportion as land was naturally fertile was sewage unlikely to prove beneficial. He would be a very hazardous farmer who, having good pasture-land, poured upon it a large quantity of sewage manure, thereby converting it into that sort of rye-grass land of which Alderman Mechi had spoken. He (Dr Voelcker) would not deny the utility of sewage rye-grass for the keeping of stock in good condition; but he maintained that pasture-grass was better; and he would appeal to those who had had more experience in this matter than himself, having resided only for a few years in the country, whether sewage did or did not increase the nutritive value of produce? His own opinion was, that the more rapidly you forced produce of any kind, the less nutritive it became, bulk for bulk; the slower it grew the more nutritive it was. On pasture-lands that was especially the case. By applying sewage to the land they gradually reduced the herbage to one or two predominant grasses, favouring the growth of the coarser kinds to the destruction of the finer; one particular grass, a coarse one, often prevailed. They all knew that in mixed herbage they had a variety of grasses, and that, bulk for bulk, those mixed grasses were more nutritive than the succulent produce which consisted of one particular kind of grass. Much of the stress laid by those who maintained that sewage grass was more nutritive than grasses which were grown in a natural way, arose from the fact that sewage produce contained most nitrogenous matter. In all the more slowly grown, and, as he conceived, more nutritious produce, there was invariably a comparatively small proportion of nitrogen, whilst in the more rank and succulent produce the proportion of nitrogen was larger; and whatever the prevalent theory might be, he contended that a large proportion of nitrogen in green food was a sure indication of an unripe and comparatively poor condition. In his opinion, so far as a large quantity of nitrogen from being an indication of richness, that it was in fact the very reverse. He had dwelt thus long on this sewage question purposely, in order to facilitate a discussion which might tend to its final solution; but he was sure that it could not be solved unless they fairly looked difficulties which surrounded it in the face, and avoided over-estimating the practical results which were likely to arise from the application of sewage to the land."

A number of other speakers followed, but for the most part their observations were repetitive of the summary we have given.

The Modern System of Draining was the subject of an elaborate paper read by Dr Liffen at the last bi-monthly meeting of the Wigton Farmers' Club. After tracing the history of modern draining, and speaking of the benefits resulting to the soil from it, Dr

Liffen remarked at considerable length upon what he considered its defects. He thought that drains, as a rule, were cut at too great intervals apart.

"We are told by engineers," said he, "that a well-pit will draw moisture of any description from all the ground, of ordinary texture, within a circle of twelve feet space or radius from the circumference of the pit itself. Taking the diameter of the pit to be four feet, we have a circle, the total diameter of which will be about twenty-eight feet, brought within the influence of the pit. Now, if a well-pit, perhaps twenty feet deep, will only relieve fourteen feet of fair drawing-ground on each side of its moisture, I would ask, How is a drain, four feet deep, in a stiff clay subsoil, to draw freely over even a similar space?"

He was of opinion that the fact that herbage is more luxuriant immediately over the drain was a hint on the part of nature that the number of drains should be increased. But the question is, Is the value of the herbage immediately over the drain so much superior to that farther away from it that it would pay to make more drains? If so, then, perhaps, it would be well to carry the Doctor's argument a little farther, and tunnel the whole earth completely. For stiff clayey lands the Doctor recommended what must be regarded as a novelty in the way of draining—viz, deep and shallow drains at intervals; a recommendation which the majority of the Club very naturally considered of very little value, as the deep drains would, as a rule, draw all the water, leaving the shallow ones a dry memorial of extravagance. The insufficiency of mains into which the subsidiary drains run was also set down as a defect in modern draining; and this is really a matter which we think deserves consideration. The mode of tiling the drain the lecturer also thought to be in many cases imperfect, and he strongly condemned the use of the flat pipe-tiles "as a substitute for the pipes and collars." Whoever invented them "did an act of the greatest unkindness to the agriculturist, and especially to the owner of the land." A drain, the Doctor thinks, ought to endure for generations, instead of being serviceable for barely one: but this permanency is only to be secured by the tiles being laid on a sound foundation, and properly secured and supported at their extremities; and this security and support can only be obtained by the use of some form of collar. Unfortunately, it has been found, to the cost of both landlord and tenant, that even with what is deemed a good foundation, and with the use of the collar and supports, drains are very far from permanent; and Dr Liffen is quite indefinite in his information upon this most important point. What is a sound foundation, and what constitutes proper security and support? are questions which the lecturer did not answer in a satisfactory manner. Among other imperfections the Doctor mentioned the mode of blinding the tile and filling the drain, the want of ventilation in drains, and the lack of information as to the actual effect produced by our drains; and he concluded by a suggestion that much

good would arise from the introduction of a part of Elkington's system into the modern practice of draining.

"Tapping the water," said he, "contained in underlying strata, and conveying it into our drains, would not only remove a source of wetness in the super-strata, but, if conducted especially into the shallower drains, which I have proposed, would provide a never-failing supply of water for the purposes of underground irrigation, which would in time effectually do away with some of the worst consequences of drought in any extraordinary dry seasons. Of course, I do not mean to say that this is universally applicable, but I conceive that it might very frequently be practised with ease, and, where available, with good effect."

The whole lecture and the long discussion which followed only served to show that, after all that has been written on the subject, landlords and farmers are still very much at sea as to the best method of conveying water from the soil. Perhaps this contrariety of opinion arises from the fact that, in considering this question, people are too apt to generalise upon it instead of treating it in detail, and as it affects particular localities.

Death of Mr John Fowler.—The news of the sudden demise of Mr John Fowler of Leeds, in the very prime of his life, and the height of his well-earned fame, will be everywhere received by agriculturists with the profoundest regret. At the early age of thirty-eight, and at the time when the arduous and unwearied labours of long years were just promising to bring in their pecuniary reward in liberal measure, he was called away to that peaceful rest which his active brain could never enjoy here. But, at half the allotted years of man, so unremitting was his assiduity, he had gone through more work than many a plodding man who has lived out his three-score years and ten. If ever the lines of the poet were applicable to any one, they were assuredly so to John Fowler :—

"We live in deeds, not years; in thoughts, not breaths;
In feelings, not in figures on a dial.

He most lives
Who thinks most—feels the noblest—acts the best."

His melancholy and premature decease is all the sadder that it was in no small degree the result of his devotion to his profession. Of him it may almost be said, as Byron sung of Kirke White :—

"O what a noble heart was here undone,
When Science's self destroyed her favourite son!
Yes, she too much indulged thy fond pursuit;
She sowed the seeds, but Death has reaped the fruit.
'Twas thine own genius gave the final blow,
And helped to plant the wound that laid thee low."

For although Mr Fowler fell from his horse in the hunting-field, and broke his arm, there is every reason to believe, but for the fact that his nervous system was unstrung by constant application to his business—that his busy brain was jaded by its never-ending search after novelties and improvements—that that fell enemy, Tetanus, which vanquished him, would not have dared to approach his bed. Mr Fowler, as will be known to most of our readers, was what may

be termed the pioneer of successful steam-cultivation—at least it was him who, by the exhibition of a steam draining-plough ten years ago, first directed the attention of a farmer, Mr Smith of Woolston, to the practicability of steam-culture; and under his superintendence Mr Smith's first apparatus was made. Since 1856 Mr Fowler had been a competitor at our great shows, both in Great Britain and on the Continent, with steam-cultivating machinery; and at every one of them he succeeded in carrying off the principal premiums. In the course of that time his prizes, leaving out of the question medals of gold and of silver, have amounted to no less a sum than £3200. As illustrative of the magnitude to which the late Mr Fowler, by his industry, ingenuity, and skill, had raised his trade—a trade, be it remembered, not in existence, and, save by a few, not believed in as possible, ten years ago—we cannot do better than quote from a recent notice in an agricultural newspaper:—

“Mr Fowler's works now cover some five or six acres of ground; and when they are completed, they will be very nearly in the form of a square. They consist of a series of brick buildings, got up in the plainest possible style, the object of the proprietor evidently being to devote his funds to the purchase of the best machinery and tools to aid him in his own great undertakings rather than to architectural ornament. The contrast between the outside of the buildings and their internal fittings is remarkable. In the one case, apparently not one penny has been laid out that could be avoided; in the other, no money has been spared that was necessary to procure the most efficient and time-saving machines, however expensive. Everything, indeed, has been done to have the buildings arranged in the manner most suitable for their several uses, and also in their relationship to each other; and, in order to secure this, substantial dwellings have been purchased and knocked down in whole rows, like so many houses of cards. But no expense, as we have said, has been laid out on merely decorative purposes.

“In order to facilitate the carriage of the raw material into the works, and the transit of the manufactured articles from them, a line of rails has been laid down from the Leeds goods station about a quarter of a mile off, which passes right round the buildings. Since this line was laid some adjoining property has been purchased by Mr Fowler, which will enable him to relay the line in a manner to economise time in loading of goods, and otherwise to make it more convenient and useful. It is easy to see, in going over the establishment, that ingenuity has been almost exhausted in the effort to secure economy in working.

“It is difficult to give on paper any adequate idea of the impression which an establishment like that of Mr Fowler makes upon one. To be thoroughly understood it must actually be seen. . . . Though mere dimensions give but a very faint idea of the magnitude of such a concern as Mr Fowler's, yet these are, after all, the best data that can be furnished to those who have not visited the works. Beginning, as it is proper to do, at the beginning—that is, with the foundry where the pig-iron is melted—we find from the plan that it is 175 feet long by 100 feet in width. The boiler-shop is of exactly the same dimensions. The heavy-tool shop—that is, where the machinery is employed in hammering, boring, planing, &c., all the heaviest work—is 125 feet long by 100 feet broad. The light-tool shop, where the more minute and finer work is done, is 125 feet long by 50 feet broad; and the store-room measures the same. Both the heavy-tool shop and the store are flagged with slabs 8 inches thick, so that they may bear without injury any weight or rough usage to which they may be subjected. The erecting and packing shops are 200 feet by 175 feet, with a height of

27 feet to the eaves. The smiths' new shop, which is not yet quite completed, measures 150 feet by 110 feet; the pattern-shop, where all models of the different parts of the machinery are made, is 100 feet by 30 feet; and the packing-case-making shop is 40 feet by 30 feet. These, be it remembered, are exclusive of the large open yards which are necessary in connection with such an establishment. When we have stated that 700 men are constantly employed in the works, we have pretty nearly exhausted our figures.

"Except the boiler-plates—the best of which come from Taylor and Brothers, Farnley ironworks, Yorkshire, others from Staffordshire, and these only in a square form, Mr Fowler putting them into the proper shape at his own furnaces—everything in connection with the manufacture, finishing, and packing of the steam-ploughing machinery is done within the walls of the Steam-Plough Works, thereby greatly economising cost.

"As a description of all the labour-saving and ingeniously-working machines in the establishment would be a profitless task to those who have not witnessed them in operation, we shall not waste space nor the patience of our readers in attempting it. Suffice it to say, that nothing that skill can devise and money command in the way of tools is here wanting.

"Mr Fowler is now turning out six steam-ploughing engines, with their appurtenances, per week. Of these, several double 14-horse engines are for the West Indies, Egypt, and Spain; while single 14-horse engines, with anchors, &c., are in demand for the East Indies."

Mr Fowler was the son of a banker in Wiltshire, and was apprenticed to an engineer in the north of England—at Middlesboro'-on-Tees, we believe. He at once devoted himself with enthusiasm to his profession, an enthusiasm with which he continued to be pervaded during the whole of his life, and which, carried to too great an excess, was, as we have indicated above, indirectly the cause of his death. Mr Fowler was not exactly the inventor of the steam-ploughing machinery which passes under his name, but to him is due the credit of perfecting and combining the minor details which were the suggestions of other men. Mr Fowler's manners were ever frank and agreeable; in public he was an apt and a fluent speaker; and in all his business-dealings he was upright and honourable. No man will be more missed at the great agricultural gatherings which annually take place in our own and other countries, and over the grave of none could more sincere regrets be expressed than that he was so soon lost to the great and progressive cause of agriculture.

Presentation to Mr Harvey, Whittingham Mains.—During the past month the agriculturists of East Lothian have done honour to themselves by honouring one of the most energetic and useful of their body in promoting and supporting all movements calculated to benefit agriculture. For sixteen years Mr Harvey has occupied, with credit to himself and advantage to the Association, the onerous post of Treasurer to the United East Lothian Agricultural Society. As a token of the estimation in which the Society holds his services, they presented him with a portrait of himself—the work of a rising young artist, Mr Norman Macbeth of Edinburgh—and also with a beautiful silver epergne, salver, and claret jug. Upon the former the following inscription was engraved:—"Presented to George

Harvey, Esq., Whittingham Mains, by the Members of the United East Lothian Agricultural Society as a mark of their appreciation of his long and valuable services as Treasurer of the Society, and also of their personal esteem for him as a friend and neighbour. 1864." The chair was occupied on the occasion of the presentation by the Marquess of Tweeddale, and many of the county gentlemen and upwards of 100 tenant-farmers were present. We are always pleased to note such meetings as this one to Mr Harvey, as they show that societies are grateful for good and honest service, and they stimulate those who are in honorary official capacities to imitate the energy and tact of the man upon whom the honour has been conferred.

The Wood-Pigeon Pest.—This question has again been before the East Lothian Agricultural Society, and we are sorry to learn from the report of the treasurer that the subscriptions do not meet the expenditure necessary to keep these gluttonous birds within anything like reasonable numbers in East Lothian. The amount of damage done by wood-pigeons to the crops is almost incalculable, and those farmers who do not subscribe of their store with a view to their diminution may be penny wise, but they are decidedly pound foolish. And the proprietors who do not lend what aid they can to the destruction of wood-pigeons are not such good friends to the tenant as we could have supposed all East Lothian landlords to be, in a matter of this kind at least. The Marquess of Tweeddale has here set an example—as he has in his day done in many other things connected with agriculture—which other landlords should follow, for without their co-operation the tenants themselves can never hope to thoroughly abate the nuisance.

Weather Conditions which determine the Growth of Crops.—In the last number of the excellent 'Quarterly Journal,' published by the Scottish Meteorological Society, there is an exceedingly interesting article on the above subject from the pen of the Secretary, Mr Buchan. For details of this paper we must refer our readers to the 'Meteorological Journal' itself, but we may quote Mr Buchan's general views as to the character of the weather necessary to produce the best crop of roots and cereals. He says :—

"*For Turnips*, the weather should be dry and mild, and the soil pulverised during the middle of May to the middle of June, when they are sown. Moisture and warmth are required in their braiding, and their growth towards the time for singling. At singling, and after the growth, the weather should be dry and warm. These include the second half of June and most of July. From July to October, when the crop is ripe, the weather should be showery at intervals, and always warm, particularly during night. *For Cereals*, the sowing months of March for oats, and April and half of May for barley, should be cool and dry. In the after-growth of wheat, barley, and oats, till the blooming season in July, the weather should be dropping and warm. The blooming season in July should be dry, warm, and calm. After that period, till within a month of harvest, at the end of August, or beginning of September, there should be showers and warmth. During the period from that to harvest it should be dry and hot, and to continue so till the crop is secured."

Chamber of Agriculture and Scottish Farmers' Club.—We are glad to learn that this institution, whose claims upon farmers for support we have more than once advocated, has at length been fairly set agoing. At a very numerous and most influential meeting (comprising farmers from all parts of the country), held in Edinburgh during All-Hallow Fair week, it was unanimously resolved that the Chamber and Club should be at once started, and in the course of the week some 200 names were put down as members; the entrance-money being one guinea, and the annual subscription a like sum. We understand that since that time many more have joined, and rooms for the members to meet in have been engaged in the Waterloo Hotel, Edinburgh, until such time as it may be deemed prudent for the Association to build a Club-house for itself. All that now remains for the Committee to do is to appoint an efficient Secretary; this once secured, we need have no fear but that the Club will soon become as useful in Scotland as the Central Club is in England. Such an association was much wanted, in order to promote friendly sociality between farmers from different parts of the country, but more particularly to secure that union, coherency, and definiteness of purpose among agriculturists which all other trades and professions possess, and which alone can give importance and influence to their demands for redress of grievances, and success to their efforts to promote improvements in the science and practice of agriculture.

The Law of Hypothec.—The names of the Royal Commission on the Law of Hypothec, after long and apparently unnecessary delay, have at length been made known to the public, and the Commission has commenced its sittings for the hearing of evidence in Edinburgh. The names of the Commission are, Sir William Gibson-Craig, the Solicitor-General, Mr Dundas of Arniston; Mr Swinton of Kimmurghame; Mr Hope, Fenton Barns; Mr Fleming, Glasgow; Mr Carnegie, M.P.; Mr Lawson, Lord Provost of Edinburgh; Mr M'Lagan of Pumpherston; Mr Curror, Myreside; and Mr Graham Murray, W.S. Evidence has been taken in private, and as yet there is no official statement as to its character, but we believe we are correct in stating that up to the present time its tendency is decidedly in favour of a very material modification of the present law.

Social Science Congress.—As an instance of how much the importance of agriculture is being recognised by the general public, it may be noted that at the meeting of the Social Science Congress at York, a section was set specially apart for the discussion of topics bearing upon agriculture. Among the papers read was one by the Rev. Canon Randolph, strongly condemnatory of hiring-fairs. Other interesting papers having reference to the social and moral condition of agricultural labourers, on cattle disease, &c., were also read and fully discussed.

Fat Shows.—The great English fat shows, Birmingham, Smithfield, Darlington, York, Liverpool, &c., have proved more than usually

successful. At some of them, indeed, so many animals were not forward as have been exhibited in former years, and the best in one or two instances have not come up to the standard of merit that has been previously reached ; but the animals at all the exhibitions may be said to have attained, on the whole, a greater perfection than ever before seen, and the interest taken in them, as evidenced by the money received from visitors at the doors, is greater than on any former occasion. At Birmingham, which leads off the ball, the short-horns as a rule were not so good, though there were a few superior animals among them ; but none of them could compare to advantage with Mr Phillips's very fine Hereford, which deservedly carried off all the prizes it could compete for, including the crowning glory of the yard, the Innkeepers' Cup. The Herefords altogether were particularly good at Birmingham, and if short-horn men do not bestir themselves, they are likely to be thrown altogether into the shade at this show. In the crosses there were some splendid cattle, and the one that ran Mr Phillips's Hereford closest for the champion cup was a stupendous cross, very evenly fed and of capital quality, belonging to the Messrs Martin of Aberdeen. At the Agricultural Hall, Islington, the short-horns retrieved their lost laurels, the two principal prizes in the yard going to them ;—one, for the best female animal, to a very excellent heifer, deep, well fed, symmetrical, and of excellent quality of flesh, shown by Mr Taylor of Kingham ; and the other, for the best male, to a lengthy, level, and well-proportioned red and white, the property of Mr Walesby, Kirkham of Louth. The latter judgment was not generally acquiesced in, as the animal was rather thin in the flank, and did not possess the large amount of excellent flesh which covered the frames of the Hereford prize ox and the Messrs Martin's cross. The question of age, however, doubtless determined the award, the beast being only two and a-half years old. The Herefords and Devons formed a remarkably good show at London, and both there and at Birmingham the sheep and pigs were considered unusually good. It may be remarked, that within the last two or three years there is evidence that feeders are beginning to understand better the science of their business, as there is now not nearly so many obese, patchy, and unshapely animals as were wont to be exhibited. Symmetry is not now sacrificed to size, and weight is obtained without flabbiness.

AVERAGE PRICE OF THE DIFFERENT KINDS OF GRAIN,

PER IMPERIAL QUARTER, SOLD AT THE FOLLOWING PLACES.

LONDON.

Date.	Wheat.	Barley.	Oats.	Rye.	Pease.	Beans.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
1864.						
Sept. 3.	43 6	34 8	20 9	29 4	42 6	39 8
10.	45 5	30 0	22 9	33 8	38 9	40 6
17.	43 8	33 5	21 4	34 9	36 10	41 10
24.	43 5	33 3	22 5	33 0	43 1	37 0
Oct. 1.	42 8	33 7	21 9	34 5	39 0	37 1
8.	41 4	29 2	22 0	36 0	39 6	39 5
15.	40 2	29 9	21 1	35 8	36 2	36 9
22.	40 7	29 9	23 0	36 0	37 11	39 11
29.	40 8	32 7	21 6	29 0	38 9	36 5
Nov. 5.	42 3	29 11	21 6	29 6	41 2	39 1
12.	40 11	31 3	19 1	30 0	37 1	36 0
19.	41 2	31 11	19 6	32 4	37 0	34 0
26.	42 4	29 3	22 11	36 3	36 3	36 5

LIVERPOOL.

Date.	Wheat.	Barley.	Oats.	Rye.	Pease.	Beans.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
1864.						
Sept. 3.	40 11	25 10	20 11	28 6	41 6	39 2
10.	40 3	26 6	24 9	29 4	40 4	39 8
17.	41 11	26 10	24 4	30 8	38 6	40 4
24.	40 9	27 4	24 10	32 6	36 8	41 6
Oct. 1.	38 3	28 6	19 10	36 2	39 2	39 2
8.	39 0	29 4	22 6	35 9	40 6	38 4
15.	37 2	28 10	19 6	35 6	38 4	36 8
22.	36 6	28 2	18 0	34 8	36 6	38 6
29.	38 0	29 8	20 3	34 2	37 4	36 4
Nov. 5.	37 10	28 6	21 8	30 6	38 6	37 6
12.	38 0	28 3	19 10	29 8	40 4	36 4
19.	37 5	28 6	22 0	29 2	38 8	34 2
26.	38 2	28 2	21 8	30 6	36 4	35 4

EDINBURGH.

Date.	Wheat.	Barley.	Oats.	Pease.	Beans.
	s. d.	s. d.	s. d.	s. d.	s. d.
1864.					
Sept. 7.	41 7	32 1	22 7	40 0	40 11
14.	41 5	31 1	23 1	41 8	42 1
21.	41 9	30 9	22 10	42 6	43 8
28.	40 3	28 5	21 10	43 8	44 6
Oct. 5.	40 3	27 3	21 2	41 6	42 7
12.	40 3	26 2	20 10	42 6	43 4
19.	41 10	27 4	21 0	39 8	40 2
26.	41 7	28 9	20 7	41 6	42 7
Nov. 2.	39 8	29 5	19 9	40 4	41 5
9.	39 7	27 2	19 7	41 6	42 4
16.	37 10	27 0	19 0	38 0	38 2
23.	38 2	26 4	17 11	37 2	37 8
30.	37 6	25 6	18 4	38 6	39 0

DUBLIN.

Date.	Wheat, p. barl. 20 st.	Barley, p. barl. 16 st.	Bere, p. barl. 17 st.	Oats, p. barl. 14 st.	Flour 9 st.
	s. d.	s. d.	s. d.	s. d.	s. d.
1864.					
Sept. 2.	23 9	16 6	14 6	11 8	18 0
9.	23 6	16 9	14 9	12 0	18 1
16.	23 10	17 0	15 0	12 2	18 0
23.	24 0	16 10	14 8	12 0	18 2
30.	23 9	16 6	14 5	11 10	18 1
Oct. 7.	23 10	16 8	14 4	12 0	18 1
14.	24 2	16 10	14 6	12 2	18 3
21.	24 6	17 0	15 2	12 3	18 3
28.	24 2	16 11	15 0	12 0	18 2
Nov. 4.	23 6	16 6	14 10	11 9	18 1
11.	23 2	16 4	14 6	11 8	18 2
18.	22 10	16 6	14 8	11 8	18 0
25.	22 8	16 4	14 6	11 6	17 10

TABLE SHOWING THE WEEKLY AVERAGE PRICE OF GRAIN,

Made up in terms of 7th and 8th Geo. IV., c. 58, and 9th and 10th Vict., c. 22. On and after 1st February 1849, the Duty payable on FOREIGN CORN imported is 1s. per quarter, and on Flour or Meal 4½d. for every cwt.

Date.	Wheat.		Barley.		Oats.		Rye.		Pease.		Beans.	
	Weekly Average.	Aggregate Average.	Weekly Average.	Aggregate Average.	Weekly Average.	Aggregate Average.	Weekly Average.	Aggregate Average.	Weekly Average.	Aggregate Average.	Weekly Average.	Aggregate Average.
1864.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
Sept. 3.	42 3	43 1	31 1	28 9	22 5	22 5	34 1	32 4	35 9	35 9	40 9	39 11
10.	42 4	42 10	32 1	29 6	21 9	21 4	34 7	32 1	36 11	35 11	41 10	40 0
17.	42 0	42 6	32 2	30 2	20 11	22 0	35 6	33 6	36 5	36 1	41 2	40 10
24.	40 11	42 1	31 0	30 9	20 11	22 0	34 7	32 10	37 1	36 2	40 7	41 0
Oct. 1.	39 8	41 7	30 11	31 1	20 7	21 0	35 4	34 5	37 0	36 5	40 4	40 11
8.	38 9	41 0	30 2	31 4	20 0	21 1	30 11	34 2	35 8	36 6	38 11	40 7
15.	38 1	40 4	29 11	31 1	20 1	20 9	33 9	34 1	35 4	36 5	39 3	40 4
22.	38 6	39 8	30 2	30 9	20 0	20 5	29 1	33 2	35 5	36 2	38 2	39 9
29.	38 9	39 2	30 2	30 6	20 1	20 3	30 9	32 5	35 0	35 11	38 0	39 2
Nov. 5.	38 11	38 9	30 3	30 3	20 2	20 2	29 9	31 7	35 5	35 8	37 9	38 9
12.	38 9	38 8	30 1	30 1	19 11	20 0	33 0	31 2	35 9	35 4	37 11	38 4
19.	38 9	38 8	29 9	30 1	19 5	19 11	32 9	31 0	34 11	35 3	37 9	38 2
26.	38 8	38 9	29 3	29 11	20 0	19 11	40 0	32 0	35 1	35 2	37 10	37 11

FOREIGN MARKETS.—PER IMPERIAL QUARTER, FREE ON BOARD.

Date.	Markets.	Wheat.			Barley.			Oats.			Rye.			Pence.			Basis.		
		s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.
1864.																			
Sept. ..	Danzig	22	6	26	0	18	0	21	6	12	6	14	6	18	0	23	0	26	0
October ..		21	6	25	6	18	0	21	0	12	0	14	0	17	6	21	6	25	6
Nov. ..		21	0	25	6	15	6	20	6	12	0	13	6	18	6	24	0	24	0
Sept. ..	Ham- burg	23	6	28	6	17	6	22	0	13	0	15	6	20	0	25	0	26	6
October ..		22	6	28	0	16	6	21	6	13	0	15	0	19	6	24	0	26	0
Nov. ..		21	6	27	6	16	0	20	6	12	6	14	6	19	0	23	6	25	0
Sept. ..	Bremen	21	6	27	0	16	0	21	0	12	6	14	6	18	6	24	0	25	6
October ..		20	6	26	6	15	6	20	6	12	0	14	0	18	0	23	6	25	0
Nov. ..		20	0	26	6	15	0	20	0	12	0	14	0	18	0	22	6	24	6
Sept. ..	Königs- berg	22	0	27	0	16	0	20	6	12	6	15	0	18	0	23	0	26	0
October ..		21	6	26	6	15	6	20	0	12	6	14	6	18	6	24	0	25	6
Nov. ..		20	6	26	0	15	0	20	0	12	0	14	0	19	0	24	6	25	0

Freights from the Baltic, from 5s. to 7s. 6d.; from the Mediterranean, from 10s. 6d. to 12s.; and by steamer from Hamburg, from 5s. to 6s. per imperial qr.

THE REVENUE.—FROM 1ST JULY 1864 TO 30TH SEPTEMBER 1864.

	Quarters ending Sept. 30.		Increase.		Decrease.		Years ending Sept. 30.		Increase.		Decrease.	
	1863.	1864.					1862.	1864.				
	£	£	£	£	£	£	£	£	£	£	£	£
Customs	5,872,000	5,624,000			248,000	23,771,000	22,573,000			1,198,000		
Excise	3,922,000	4,352,000	430,000			16,992,000	19,098,000	2,106,000				
Stamps	2,191,000	2,267,000	76,000			9,140,000	9,538,000	398,000				
Taxes	176,000	168,000		8,000		3,193,000	3,252,000	59,000				
Post-Office ..	905,000	1,045,000	140,000			3,760,000	3,960,000	200,000				
Miscellaneous	479,504	554,480	74,980			3,027,323	3,808,944	781,621				
Property-Tax	866,000	782,000		84,000		10,605,000	8,551,000			2,054,000		
Total Income	14,411,505	14,792,480	380,980	380,980		70,488,382	70,273,944	214,438				
Deduct decrease			340,000				Deduct increase					
Increase on the qr. ..			380,980				Decrease on the year					

PRICES OF BUTCHER-MEAT.—PER STONE OF 14 POUNDS.

Date.	LONDON.		LIVERPOOL.		NEWCASTLE.		EDINBURGH.		GLASGOW.	
	Beef.	Mutton.	Beef.	Mutton.	Beef.	Mutton.	Beef.	Mutton.	Beef.	Mutton.
1864.	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.
Sept. ..	8 0	9 0	8 3	9 6	7 6	8 9	8 3	9 3	7 8	8 6
October ..	8 0	8 8	8 0	9 3	7 6	8 4	8 0	9 0	7 8	8 6
Nov. ..	8 0	8 6	8 0	9 0	7 6	8 6	8 0	9 0	7 8	8 6

PRICES OF ENGLISH AND SCOTCH WOOLS.—PER STONE OF 14 POUNDS.

ENGLISH.				SCOTCH.			
	s.	d.	s.		s.	d.	s.
Merino,	25	0	to 30	6	Leicester Hogg,	30	0
.. in grease,	20	0	to 25	6	.. Ewe and Hogg,	24	0
South-Down,	25	6	to 32	0	Cheviot, white,	30	0
Half-Bred,	20	0	to 26	0	.. laid, washed,	14	0
Leicester Hogg,	26	0	to 33	0	.. unwashed,	12	0
.. Ewe and Hogg,	22	6	to 29	0	Moor, white,	12	0
Locks,	11	6	to 14	6	.. laid, washed,	9	0
Moor,	9	0	to 12	0	.. unwashed,	8	0

ON THE MEANS OF INCREASING THE NUMBER OF LIVE-STOCK,
AND THE PRODUCTION OF MEAT.

WE are not overstating the matter when we say that the price of butcher-meat is perhaps one of the most universally absorbing topics of the day; and that, in the opinion of many, nearly all the ills of life may be regarded as concentrated in one—the heavy pressure of the butcher's bill. And, poor fellows! they have their own share of trouble, being not merely grumbled at, but often actually charged with having established “a tyrannical monopoly,” as we have seen it described, whereby the price of meat is represented as being unduly raised, and, as a necessary consequence—for so “the opponents of monopoly” assert—their own profits enormously increased.

It is, of course, unnecessary to say to the readers of the ‘Journal of Agriculture’ that the cause of the high prices which consumers have had to pay for meat does not rest with the butcher. He has to pay a correspondingly high price to the farmer who fattened the cattle and sheep; and although not belonging to the brotherhood of the cleaver, yet we are quite aware that it is not during a run of extremely high prices for meat, such as the consuming public are paying, and have been paying for a considerable time, that the butcher's profits rate the highest. In fact, an extremely high range of prices tends to injure the victualling trade, because, while customers in good circumstances endeavour to consume less meat, the poorer class are prevented from buying; so that the butcher is much more likely to have a chance of living by his business when the price of meat is moderate, than when it is higher than suits the purses of the public in general.

But, partly as a matter of some general interest, and partly to satisfy any scruples which may exist as to the rate at which butchers are remunerated while prices have a high range, we shall quote the following statement, which we take from the ‘Doncaster Gazette,’ Dec. 1864, and which shows the effect on the butchers' trade of the present high price of meat:—

Cost of a fat heifer, 40 stones weight at 8s.,	£16	0	0
Slaughtering ditto,	0	2	0
Slaughterhouse charges,	0	1	0
Total,	£16	3	0

PROCEEDS FROM SALE OF DITTO.

	st. lb.		
Rumps, buttocks, and inner steaks,	13 7	at 8s.,	£5 8 0
Crops and sirloins,	7 0	„ 9s. 6d.,	3 6 6
Briskets and thin ribs,	8 0	„ 7s. 6d.,	3 0 0
Fore-ends from the nicking,	9 0	„ 7s.,	3 3 0
Bones taking out,	1 7		
Loss of weight through drought,	1 0		
Total,	40 0		
		Carry forward,	£14 17 6

	Brought forward,	£14 17 6
Hide, 4 stones, at 3s.,	.	0 12 0
Tallow, 4 stones, at 3s. 6d.,	.	0 14 0
Head, tongue, liver, &c.,	.	0 6 6
	Total,	£16 10 0
	Cost,	16 3 0
	Net profit,	£0 7 0

It may be said that higher retail prices would be charged by the butcher than those set forth in the foregoing statement, and perhaps such might be the case; but even granting that it were so, the wholesale price—that which the butcher is represented as paying for the heifer—is not over-estimated; and prime beasts have cost 1s. to 1s. 6d. a stone more than the rate upon which the foregoing calculation is founded. Then there is no allowance for credit to customers, with the risk of bad debts, &c.; and, at all events, it must be evident that the high price of meat at the present day is not the fault of the butchers, as the anti-beef-and-mutton-eatingites—who have raised the cry of “monopoly,” which they suggest should be put down by abstaining from animal food—so pertinaciously aver.

While, therefore, butchers can relieve themselves without much difficulty from the charge of artificially creating a high range of prices, those who prepare the stock for the market, the feeders, point to the quotations of “cake” as being of such a nature as to tell seriously on their profits. With still more effect they refer to the immense rise in the value of lean cattle, which compels them to lay in stock for fattening at rates by no means corresponding with the value of the same when fat; that is, as scarcely leaving any margin for the realisation of what is called “a living profit.” And this scarcity of lean stock—scarcity being the leading reason why this class of animals has been so dear of late years—is, after all, the true cause of the high price of meat to consumers. Butcher-meat enters more largely than it once did into the dietary of the general population; there are also more mouths to feed; and thus, notwithstanding extensive importations of cured provisions, as well as of living animals, the supply is not nearly equal to the requirements of the nation.

Those who have been long enough engaged in farming to allow them to look back nearly thirty years, cannot fail to be surprised at the difference in the prices then and now of lean stock. For the information, however, of some of our younger readers, we shall avail ourselves of some very interesting extracts from a series of articles published in the ‘Banffshire Journal’ during last December. Those articles were founded on the ‘Journal of a Banffshire farmer for nearly forty years;’ the rural diarist in question being Mr George M’Willie, late of Midthird, in the parish of Botriphnie.

Mr M’Willie’s journal commenced on 1st January 1826, and the

following are some of the particulars which he has recorded regarding the prices of cattle :—

1831.—In the month of August of this year, three-year-old stots brought from £5 to £7 a-head.

1832.—Beef sold at 3d. per lb. ; queys at £3, 5s. a-head, and stots at £11, 15s. the pair.

1833.—“Cattle,” says Mr M'Willie, “are *selling well* this spring—three-year-olds £7 to £12!” As the year advances he again records that “cattle are selling well this year ; queys £4, 10s. to £6, and three-year-olds [oxen, we suppose] £7 to £9 and £10, according to quality.”

1834.—The only reference to the prices of cattle we find is a note to the effect that the price of a “hummel cow” in the market was £6, 14s.

In 1835, “three-year-old stots were selling at £6 to £9 ;” and Mr M'Willie mentions that he “purchased a two-year-old bull for £4, 5s., and sold an old mare for £1, 12s. 6d.”

In 1836, the venerable diarist sold two queys at £8, 10s. ; five stots at £6, 10s., and a young colt at £15, and he also “purchased a stot at a roup for £3.”

In 1837, his transactions in the cattle line seem to have been selling three-year-olds at £5, 5s. ; a bull at £4, 6s. ; and “a fat quey” at £4 ; besides buying three stots for £9, 1s.

In 1838, cows are recorded as selling at about £4, 7s. 6d. ; stots and queys at about “former quotations.”

Finally, in 1840, Mr M'Willie, or “Midthird,” as he was commonly known, from the name of his farm, sold five queys for five guineas a-head, and two stots for £14. He also records “a good Dufftown market, two-year-olds selling at £7 to £9, and other cattle in proportion.”

To show the contrast between the prices recorded by this Banffshire farmer and those of the present day, it is only necessary to turn to the local-market reports given in the same impressions of the ‘Journal’ which contain the extracts from Mr M'Willie's diary. Beef was quoted at Old Meldrum, Huntly, and Dufftown, as realising 70s. to 75s. per cwt., “stots” being sold in lots at £30 each ; this, be it remembered, being just after the top lots in the district had been cleared out for the London Christmas market. In the early part of December, at the Forres fat market, Mr Harris sold a bullock at £65, ten three-year-olds at £50 each, and six crosses at £43 each. Mr Fraser, Brackla, sold a pair at £50 a-head, rising four-years-old. Mr M'Kessack, Grangegreen, sold ten polled two-year-olds at £45 each ; a lot of ten crosses also at £45 each ; and a lot of seven two-year-olds at £35 each. Sir A. P. Gordon Cumming sold a lot of two-year-olds at £32 a-head. Mr Garden also sold a lot of the same age, at a similar figure ; and, irrespective of what was forwarded by the Highland line of railway, the value of the cattle sent

south from Aberdeen during the week previous to the London Christmas market was estimated at about £50,000.

Nothing could show more clearly the difference between the prices realised by farmers five-and-twenty or thirty years ago, as compared with present rates, than the extracts we have given. It is quite true there is a difference in the description of cattle now bred and fattened for market, the cattle of the present day being much superior. This is greatly owing to improved cultivation, which has admitted a better description of beasts to be bred and fattened than at the period to which we have referred back. For instance, twenty-five years ago, the writer bought a farmer's "cast" of two-year-old stots, and very good Highland stots they were, at £3, 3s. each. Early last summer he saw a lot of year-olds sold off the same farm at £14 a-head, the farm having been improved in the mean time, and a superior class of cattle reared on it. But notwithstanding the increased value of the animals, owing to their superior breeding and better feeding, and notwithstanding also that more cattle are bred at the present day in many parts of the kingdom—though not in all—than there were a quarter of a century ago, yet we must come back to the obvious fact which meets us everywhere, and which presses upon every feeder of stock for market, and upon every consumer of butcher-meat—namely, that the supply of young stock, both sheep and cattle, is not sufficient to satisfy the demand which exists for it. We are not, it must be observed, alluding at present to importations of foreign animals, which are both large and increasing in numbers, and, we may also add, improving in quality, owing to the readiness with which foreign breeders are picking up English bulls and rams for the improvement of their native breeds.

The best means of increasing the production of cattle and sheep has supplied an ample field for discussion at meetings of the different farmers' clubs, and some valuable opinions have been elicited. It is not our intention, however, to review the proceedings at those meetings, although we may have occasion to refer to some of them in illustration of our own views.

Starting on the principle laid down by Mechi, that "we must make the acres we have yield up a larger increase, as we cannot extend them," the question, taken in relation to the supply of stock, is, how is this to be done? Some, looking at the low price of grain and the high prices obtained for stock, say that the plan to be taken is to have a larger area of our farms in pasture—in fact, to make pasture the leading feature. This assumes that grain is not likely to attain a much higher average than that at which it has ranged for some time past; it also assumes that established rotations can be summarily altered; it takes, likewise, for granted, that extension of pasture must necessarily involve an increased production of live-stock; and, finally, that the value of stock will not be materially lowered. These are all points which are extremely open to criticism, and regarding which there must be considerable difference of opinion.

As the maintenance of sheep and cattle depends on the quantity and quality of the food at command, it is obvious, we think, that in order to effect an increased production of live stock, we must devote our attention to an increase in the food which requires to be provided for them. These are, first, roots and artificial grasses; and, secondly, artificial or supplementary food, in which we include grain. But it is not the production of live-stock alone which is affected by those points in farm management. The production of corn follows as a necessary element; and, in fact, the corn-crops of a farm depend to a great extent on the stock kept upon it. There is an intimate connection between stock and crop, and they are not antagonistic, as some would seem to infer, but they must be properly balanced, which is not the case in some parts of England, where, as Mr Smith stated in the paper he read at the Central Farmers' Club, December 1862, "very little provision is made for summer grazing, corn being all the fashion, and their only dependence being that of the barn-door." This is quite as objectionable a state of matters as that of all pasture on arable land, and no corn or root crops, which we find regarded in some parts of the kingdom as the height of agricultural skill, and the summit of agricultural felicity. Unless in the case of exceedingly rich natural-grass pastures, the production of meat and manure depends on roots and artificial grasses; and the rich natural pastures occupy such a small proportion of the acreage of the British Islands, that they may be put altogether aside in considering the subject of increased meat-production.

The want of proper statistical information prevents us from ascertaining the exact proportion which the cultivation of roots bears to other crops in English farming. We know that in some districts a proper proportion of roots is grown, but we also know that there are other parts of South Britain where root cultivation is by no means the rule. This is the case, for instance, where the only dependence is "the barn-door;" and where this obtains, it is utterly impossible that the land can be in a high state of cultivation, for high cultivation presupposes a large area of roots. The Scotch returns from 1854 to 1857, both inclusive, give us from $12\frac{1}{4}$ per cent to about $13\frac{1}{2}$ per cent—a gradually increasing percentage—as the proportion which turnips bore to the other crops grown in rotation throughout Scotland. The proportion rose as high as $19\frac{1}{4}$ per cent in some districts—Roxburgh, for instance; and sank as low as a little more than $4\frac{1}{2}$ per cent, as in the case of Renfrewshire,—a circumstance owing to the locality of that county rendering the cultivation of potatoes for the Glasgow and Paisley markets apparently more profitable than that of roots for the use of live-stock. In all the counties noted for the excellence of the stock reared or finished within their bounds, turnips stood high in the proportional average, and the general tendency during the years when the Scotch returns were collected was to increase the pro-

portion rather than to diminish it. Mangolds occupy only a comparatively limited acreage in Scotland, and need not be taken into account. But it is different in Ireland; and when we put together the turnips and mangolds grown in the sister country, we find that this class of crops occupies 351,389 acres out of the 5,705,636 acres returned as under crops, including 32,656 acres of fallow land—that is, there is double the quantity of turnips grown in Scotland than of both turnips and mangolds in Ireland.

There is thus plenty of room to increase the production of one description of food for stock, and thereby lead to an increase in point of numbers. That the Scotch proportion of turnips may be increased is shown by the returns, for the average acreage for each year gradually increased; and the reduction of the acreage under potatoes, which may very safely be effected, will further help to raise the average acreage under turnips. We have said that potato-cultivation may be advantageously lessened in Scotland, and when we say this we do not stand alone in our opinion. For instance, Mr Douglas, Athelstaneford, expressed himself in the following terms at a late meeting of the East Lothian Club, when the subject for discussion was the expediency of increasing the number of sheep in the county, and the most profitable varieties to cultivate:—

“When we look at a period antecedent to the last four years, we find the average of wheat something like 52s. or 53s. per qr., and I am aware that the rents of not a few of the farms that have been let in the county during the last eight years are payable one-half in money, calculated at the average price of wheat for the preceding nineteen years, or about 53s. per qr., the other half being paid in grain, according to the fiars prices. Now this, it will be observed, was a positive loss to the farmer of 13s. per qr. on that portion of the farm for which he pays money, independent of the increased rent they had to pay owing to the demand for land,—arising, it is said, from the profit that resulted from the growing of potatoes, and the faith in the margin of profit which high farming was sure to give; but these calculations have turned out like many others made by shortsighted, erring men—‘the baseless fabric of a vision.’ Why, since railway communication has extended itself over the length and breadth of the land, everybody on every available piece of land must needs grow potatoes, so that they are now produced in sufficient quantity to supply double the demand, and the consequence is that the crop, instead of leaving a profit, only barely suffices to pay for the additional labour and outlay in manure necessary to maintain the fertility of the soil under that description of cropping, so that the potato mania has got a very considerable check, and will now, for the reasons stated—not to speak of the risk of disease—be only cultivated, at least to any extent, on those farms favourably situated to railways, and well suited to their growth. I may here be allowed to state that there is not so much profit as one would suppose in growing potatoes at £20 per Scotch acre, everything considered; and last year many farmers for average crops only realised from £10 to £14. So much for great expectations.”

A check to “the potato mania” must result in an increased acreage being devoted to turnips, especially now that people have their attention so forcibly drawn to the cultivation of those crops which tend most to increase the production of beef and mutton. There is

also the increased acreage under turnips and other crops which is being gained in many parts of Scotland by the reclamation of waste lands, and this increased acreage is of a much greater extent than many people seem to be aware. Then, again, it is possible to increase the quantity of roots produced per acre by better cultivation. It is true, no doubt, that acreable produce is very much dependent on seasons; yet, taking the average of years, it is by no means unreasonable to say that the turnip crops on many farms are seldom so heavy as they might be and would be if all the essential details of cultivation were more efficiently carried into execution all through the country; and, we may ask, why should not two successive crops of roots be taken? for we know more than one case where this has been regularly practised for several years with the most satisfactory results. A crop of swedes or mangolds is grown upon farmyard dung, and a little artificial manure to start the plants. The roots in this case are consumed in the cattle-yards. Next year Aberdeens are sown on artificial manure alone, and this crop is eaten on the ground by sheep. This system has been very successful on a middling class of land, both for the purpose of fertilisation and of maintaining a large number of cattle and sheep.

When the cultivation of turnips in many parts of England and a great deal of Ireland is considered in detail, it is easy to see that there is plenty of room for improvement—that not only might a vastly increased acreage be profitably put under roots, but also that the acreable yield could be very much increased. Now these are not minor considerations, nor are they disconnected with the subject which we are discussing; for increased production of roots brings an increase of food, leads to larger supplies of stock in those parts of the kingdom where the extension of acreage and augmentation of acreable yield take place; and it is the accumulation of such additional supplies of stock, drawn from different districts, which results in larger supplies of lean animals for the purposes of the grazier, and ultimately larger and better supplies of meat for the customers of our butchers.

The next point is the part which the artificial grasses play in the production of meat. Roots serve for winter food, but we must look to the pasture-break of the farm for the summer supply. On many arable farms the grass-break is limited to one year's pasture; and thus it comes that occasionally we find only one-sixth part, or it may be one-fourth part, of a farm in grass. In such cases a modification of the system is worthy of consideration, and for the most part we think that it would be found advisable to extend the grass-break for another year, and even for a third year, in some instances. This is altogether different from the system of laying down land to remain in permanent pasture, which has been advocated by some as the system best suited for the majority of cases,

and that also which ought to secure the greatest increase in the number of live-stock. But those who assert this, forget altogether that, unless provision is made for a proper supply of winter food, stock cannot increase, for the winter months are the most trying; and it does not matter one whit how good the summer and autumn condition of stock may be if that condition is lost during winter owing to a lack of food. But when grass forms part of a regular rotation of crops—whether the pasture-break extends over one, two, or three years—it is kept up in connection with a proportional acreage under roots, and this prevents the waste of food from subsequent loss of condition, which inevitably takes place when there is nothing to fall back upon during winter except a little hay. The hay may, indeed, be assisted by supplies of artificial food; but if so, it is usually a costly mode of carrying on stock, and one which it is not likely the majority of graziers would pursue were all the land in the country laid down in permanent pasture.

Pasture in a rotation is quite another thing, and the question is, How can it be rendered as productive as possible during the two or three years the land remains in that state? We take it for granted that the soil is of a suitable nature, for there are some soils which will not produce pasture even for a second year, though tolerably fertile in other respects. At the same time, we know several cases where even land of this description has been improved for pasture by draining, deep tillage, and liberal manuring. Deep cultivation has, in fact, a wonderful effect—wonderful, at least, to those who have never realised it—in altering the condition of many soils which, previous to its application, appeared to be almost hopeless cases. There are too many to whom the reproof of the worthy Triptolemus Yellowley is still applicable—"Ye scart the land with a bit thing ye ca' a pleugh; ye might as weel give it a ritt with the teeth of a redding-kame. Oh, to see the sock, and the heel, and the sole-clout of a real steady Scottish [Tweeddale] pleugh, with a chield like Sampson between the stilts, laying a weight on them would keep down a mountain; going through soil and till, and leaving a fur in the ground would carry off water like a caused syver! They that have seen a sight like that have seen something to crack about."

The 'Improvement of Pastures' having formed the subject of another article in this volume of the Journal, we need not go over the ground a second time, but there is one point to which we may allude in connection with the subject we are considering at present. We mean the increased number of sheep or cattle which can be maintained during summer and autumn on pastures, particularly those of a middling or inferior nature, by the assistance of such artificial food as cake, corn, &c. Auxiliary food in such cases raises inferior pastures to a level with those of a first-rate charac-

ter, so far as the production of meat is concerned, while the very nature of the pastures become changed for the better, in consequence of the richer quality of the droppings of the animals. A reference to the article mentioned will show that the quantity of stock which pastures treated in this manner could keep, increased from 10 to 50 per cent; and Mr Hope stated, at the recent East Lothian meeting, that he found, "by feeding sheep with corn or cake on the first year's pasture, it improves the grass wonderfully for the succeeding year, and likewise that the sheep pay for the extra keep." He added—"But more than that; I have had large crops of potatoes after three-year-old grass with an application of artificial manures only, and the succeeding crops of wheat without any manure at all have been beyond anything I ever grew before." This is exactly what is wanted—namely, improved pasture in a rotation—improved, too, by means which pay directly through the animals fed upon it—and increased fertility for the advantage of the crops afterwards grown on the land. The practice of giving artificial food to sheep and cattle fed on grass has, therefore, everything to recommend it, and we feel sure must ere long be extensively followed.

The remarks made by Mr Wallis, in the paper read by him at the meeting of the Central Farmers' Club, and those of other members who took part in the discussion, as quoted in the article mentioned above, shows the feeling with which it is regarded by some leading agriculturists in England, and in further illustration of the subject we shall quote from a speech delivered by Mr Clutton at the late annual meeting in connection with the Reigate Fat Stock Show. Mr Clutton said—

"He felt an interest in the society, and liked to send good stock to the annual exhibition; but for all that, he liked to get a profit upon all that he did send, and he did so. He had turned out 100 beasts in his pastures, and every one of them had paid him a profit. They might improve their pastures so as to raise the value of them to the tenant-farmer from 30s. per acre to 50s. per acre. He began this experiment with great caution, and with some trepidation. It was effected by feeding the stock through the summer with cake, and the use of the cake rendered the land practically worth 20s. more an acre. To make stock pay, a farmer must, in the first place, get good lean stock; he must keep it well, and see that it is properly looked after and attended to; and then, even in the worst times, a man might get a profit by it. An important thing in preparing stock for a market, or for a show, was to see that from first to last it was kept in an improving condition, and never allowed to go back. Directly any animal got his skin sticking to his ribs, it took a great deal to bring him forward again, and that would never pay. He was quite satisfied with the plan he had adopted of feeding his beasts with cake in the summer. What did it amount to keep an animal in that way for two years? 2 lb. of cake per day would only cost £3 throughout the year."

The range of auxiliary food which may be used for stock on pasture is wide, and includes not only the different varieties of oil-cake, but also grain both of home growth and imported. Of the

former, oats, beans, pease, and barley will be most generally resorted to ; for although low rates for wheat have caused considerable quantities of that kind of grain, particularly secondary sorts, to be used of late, yet we are very much of Mr Paton's opinion, as expressed at the East Lothian meeting—namely, that wheat was never intended to be applied for feeding stock, and that, dear as butcher-meat is, it will not pay to grow wheat merely for the purpose of feeding stock with it. Then we have the imported Indian-corn, and its utility as an addition to our list of feeding-stuffs for live-stock is unquestionable, containing as it does from 11 to 12 per cent of “flesh-forming” matter, and about 68 per cent of respiratory and heat-producing constituents, of which oil or fat forms from 8 to 9 per cent. Practical experience has also satisfactorily tested its value both in the field and fold-yard, and thus we are enabled to draw from the fertile plains of other countries materials with which we not only carry on the production of a “description of food of the greatest importance to our population, but also to effect” thereby the enrichment of British soils. Lentils are also valuable as food for live-stock, belonging to the same class of plants as beans and pease, and differing, in fact, very little in composition.

There is one class of soils which it has always been found difficult to deal with relative to the production of meat—we mean strong, heavy clays, of which there exists a considerably larger proportion in England than in Scotland. North of the Tweed, the carses may be considered the leading examples of this class of soil ; and the almost sole dependence of the carse farmers on grain has tended to render their case, under present circumstances, worse than that of their brethren who farm soils which are better suited for the maintenance of cattle and sheep. The following gloomy account of the condition of the carse farmers appeared in the ‘North British Agriculturist’ of January 4, 1865 :—

“As to the prices of grain and the prospects of grain-growing farmers, the one is so low and the other so bad that farmers have ceased speaking about them, whatever they may think. Some landlords have given modifications extending years back, with ameliorations forward. Some have frankly given discounts, others grudgingly clogged with conditions, and it may be that in some cases the tenants have kept the luckpenny in their own hand. As to agricultural improvement, there is no such thing going on ; although there is plenty of land requiring draining, and fine weather for the operation, you will not see a drainer in the field, neither meet a cart of tiles on the road, and the tilemakers' yards are full to overflowing, and as quiet as a Sabbath. Things cannot long remain in the present state, or rather will not. The tenants' capital is diminishing. A worthy carse farmer on easy-rented land and plenty of capital says he has been losing at the rate of 17s. per acre per annum for some years past. The land, as a consequence, is getting out of condition, and landlords will either have to resume and farm themselves, or let it at what it is worth ; and well-farmed land is worth something yet, bad as times are ; at the same time a great deal of capital would require to be invested in the carses in the way of

drainage, and adding to the accommodation, ere it can be farmed with pleasure or profit."

"Things," as the writer of the foregoing report justly observes, "cannot long remain in the present state;" and while we have no doubt landlords in that district will see that their interest lies in making such arrangements as the nature of the case requires, it would be well, we think, if carse farmers directed their attention to a practical consideration of the question, how far the system of cultivation pursued on their strong clays could be turned to account for the maintenance of live-stock? that is, to a greater extent than has hitherto been the case.

At present, we believe that, taking the average of the carses about Stirling, there is at least a fourth of the "fallow-break" in turnips. Some farmers, indeed, grow a larger proportion of roots, and the extent would no doubt be materially increased if there was more done in the way of drainage, as described by the reporter to the 'North British Agriculturist.' The roots grown at present are consumed in the strawyards by cattle, some of which are reared on the farms, and others are bought in for the purpose. In some cases cattle are taken in "to winter" in the strawyards, getting as much straw and turnips as they can consume, for which the carse farmer charges about £3 a-head. When a farmer in that district has young stock which he wishes to carry on over summer and autumn, he requires to rent a "grass-park" for the season in another part of the country.

There is one point in English heavy-land cultivation which deserves, we think, some consideration on the part of carse farmers. This is the practice of growing vetches, which are partly consumed on the ground by sheep, and partly in courtyards by cattle. It was brought forward by Mr Paton at the recent meeting of the East Lothian Club, when speaking of land that cannot be kept in pasture for more than one year. Mr Paton said:—

"But if it will not grow pasture profitably, surely by manuring it will grow tares; and we all know how fond all kinds of stock are of them, and how well they thrive upon them. No doubt, tares often leave the land in a very dirty condition, and, if taken as a green crop, often leave their bad effects during the whole rotation; but ought they ever to be sown as cleaning or green crop? Taking the average price of beef or mutton for the last seven years, I am convinced that a good crop of tares, partly cut and carried into courts for cattle, and the remainder eaten on the ground by sheep (after the English fashion, by cutting them and carrying them to the back of the hurdles and allowing the sheep to pull them through)—I say that a good crop of tares consumed in this form will pay as much, if not a deal more, than beans, and leave the land cleaner too; and how well they come in, too, in the hot and dry months of July and August, when the grass is often so scarce! By having them drilled and hoed, all annual weeds can be pretty well kept in check."

When vetches, or tares as they are commonly called in Scotland, are sown early in spring, the seed should be mixed with beans,

which will be found to improve the forage materially; and when cake or corn is added, an acre of land cropped in this manner will keep a large number of sheep or beasts, and render them fit for market. Mr Bond, Kentwell, keeps a flock of 500 Hampshire ewes on a heavy-clay farm in Suffolk, yard-feeding them during winter on cut barley, oat, bean, pea, or wheat straw, chaffed and given in troughs, with the help of a few turnips or mangolds on a piece of pasture where the sheep are turned out daily for exercise, and some rape-cake and cow-cabbage on the approach of the lambing season. Mr Bond's sheep have returned him a fair profit, notwithstanding the disadvantages under which he laboured in consequence of the very heavy nature of his soil; and his experience seems to prove that even soils of that description—carse-lands, for instance—may be made more available than they have hitherto been in furnishing supplies for the meat-markets. Although one year's grass is generally the rule on carse-farms, yet we do not see why there may not be, say a field of valuable permanent pasture on each farm, as part of the meat-producing economy of the farm, should such be considered desirable; and it strikes us that there exists in the immediate vicinity of Stirling some very good examples, which prove that carse-land produces valuable pasture when it has been properly taken care of. We would not wish that it would be thought for a moment that our remarks are penned in a dictatorial spirit; but when we read such depressing accounts as that which we have quoted from the 'North British Agriculturist,' and when we know that the accounts are true, and that the hard-working farmers of the carses find it very difficult "to warsle through" under present circumstances, it would be unfriendly if we did not give them a hint, at least, of what was done elsewhere with soils somewhat similar to those which they are cultivating.

The practice of growing tares to be fed off by sheep must not be considered, however, as only applicable to heavy soils. It can be introduced on other kinds of land with much advantage, and we may be permitted to refer, in illustration, to the practice of one who is justly regarded as an authority—we mean Mr Wilson, Edington Mains. That gentleman has communicated his experience of growing tares for sheep-feed to the 'North British Agriculturist,' in a letter which appeared in the impression of that journal of January 25, in the current year. Mr Wilson prefers the small English or foreign vetch, as much of the haulm of the Scotch variety is apt to get destroyed from lodging. He sows his main crop in March—winter tares being unadvisable where game is plenty—and he makes a second sowing when the first begins to cover the ground. The first is in full bloom and ready for use by the third week in July, when the lambs are weaned.

"A space of sufficient breadth being cleared of the crop, a row of hurdles sparred vertically is set along the edge of the growing crop, a swathe of

which is mown and put forward close to the outside of the hurdles, so that the sheep can get at them through the spaces. The number of hurdles must of course be proportioned to the flock, at the rate of a foot per sheep. A man to mow, with a boy to put forward the swathes to the hurdles, will suffice for from 16 to 18 scores of hoggets. The hurdles require to be shifted forward to the growing crop daily. Towards evening is the best time for doing this, as the pickings are available for the flock during the night; the leavings where the hurdles last stood require to be spread out at the same time. The hoggs will be much the better of half a pound linseed-cake per head per diem along with the tares; but there is no need to exceed this, for it must be kept in mind that the pods of the tares are rapidly filling at that season, and yielding an increasing allowance of green pulse to the flock. While sheep are thus fed upon tares, it is absolutely indispensable to their welfare that they have a constant supply of water. It is desirable to have a pasture near at hand into which to turn the flock on Sundays. I find my lambs to thrive well under this treatment. They are usually healthy while feeding on tares; and when put to turnips I have observed that they take to them more readily, and that I have fewer deaths through the winter than is the case with those that have been summered on ordinary pasture. This plan of eating the crop through sparred hurdles is undoubtedly the most economical and satisfactory. To fold the flock upon the growing crop involves such waste, and so fouls the feed, that no man who tries it once will ever do so again. Carting the tares to a pasture, and spreading them thinly out, is good practice so far as the well-doing of the flock is concerned, but it involves much labour, and it robs the land on which the crop is grown of the valuable manuring which it would receive by consuming it there."

But the food given to live-stock is not the only means we can command for the purpose of making "the acres we have yield up a larger increase." The description of stock which is kept on those acres has a good deal to do with a settlement of the question. This is, of course, self-evident; otherwise, all our cattle-shows are without any tangible object. The improvement of stock has for its chief aim the supply of meat, and that this point forms an important part of the question, was shown by the prominence given to it in the discussion which took place at the meeting of the East Lothian Club. Judicious crossing, in the case of both sheep and cattle, "has done much," as was remarked in an article on 'Crossing' in an early part of this volume, "towards increasing the supplies of meat;" and if that system is properly carried out, due attention being paid to the maintenance of valuable pure breeds, much good will continue to result from it; but if bad bulls or bad rams are used, then loss and disappointment must ensue, just as we find to be the case when these all-essential preliminaries in crossing are not attended to as they should be.

As to the particular breeds which it is desirable to encourage, that depends on soil and climate; for a breed which may be very profitable in one district will often be found quite unsuitable for another, and circumstances must also determine whether sheep or beasts are best adapted for any particular locality. There is, however, one class of animals to which, we consider, too little attention is paid in Scotland, taking their meat-producing capabilities into account—we

mean swine. According to the Scotch returns for 1857, Dumfries, Ayr, and Aberdeen were the leading counties in Scotland with respect to this class of stock, while in some counties the numbers reported were exceedingly small. A good breed of pigs—such as the Berkshire—fattens readily, and while fit for market at an early age, arrive also at great weights. In fact, we are of opinion that when a good breed is selected, and the feeding properly looked after, pigs put up flesh faster, and pay fully as well for their keep as any other kind of animal, if not better. We know, for instance, of Berkshire pigs being sold to the curer when seven months old, and weighing over 200 lb., and also that pigs of the same breed were killed last December, when only five and a half months old, at which time they weighed 146 lb. each. We know that well-bred Berkshire pigs can be fed to weigh 3 cwt. at a year old, so that, allowing a sow to have ten pigs in a litter, here is a ton and a half of meat brought into the market in the course of a year through the medium of a single animal, not taking into account other litters she would produce during that time. Of course, in order to bring pigs to the weights mentioned, it is necessary to feed them well from the time they are farrowed, but this is nothing more than the principle carried out by judicious feeders with regard to other varieties of live-stock. The great error which many fall into with respect to swine, is making them merely the scavengers of the farm, and allowing them to pick up condition as they best can, without bestowing much extra trouble on them.

In conclusion, we think that the agitation which has been going on for some time past regarding the production of additional supplies of meat, will ultimately be productive of much good, because it has forced people to turn their attention to defective points in agricultural practice, and this will lead to a more speedy reformation in such particulars than might have taken place if the present pressure had not arisen. There may, indeed, be some diversity of opinion on minor matters, but there cannot be any very wide difference regarding essentials, at least among intelligent men. With all the knowledge which exists on the subject, there are many points in which we are as yet but feeling our way; and while some are further advanced than others, even those who know most are aware that there is still much to learn in this as well as in other departments of agricultural science and practice.

THE LINEN TRADE, AND ITS RELATION TO AGRICULTURE.*

IN various articles in this Journal we have treated of The Sea, of Meteorology, of Paper, and their respective relations to agriculture. If any of our readers experienced difficulty in at once perceiving the bearing of such topics on matters of rural economy, they cannot fail readily to recognise the connection betwixt land and linen. The farmer is not merely the medium through which we receive our daily bread; he is also, especially in these times of dear cotton, called upon to supply us with raiment, woollen or linen; and, if so disposed, he may, as a grower of hemp, not only keep up the supply of "hempen cravats" (much out of fashion in these days of ultra-humanity, when hanging is hooted at as too horrible), but may also furnish sails and cordage for our immense fleets, whose sails flutter in every sea. Of the nature of the demands on the agriculturist in the last-mentioned articles, some idea may be formed when it is known that the sails and cordage of a first-rate man-of-war require for their construction no less than 180,000 pounds of hemp.

In 'The Horse and His Rider,' in which Sir Francis B. Head manages to mix up much valuable information with no small amount of facetiousness, we are informed that "in a climate like ours we ought to select as materials for clothing the fur, feathers, wool, or hair of the creatures by which we are surrounded. But instead of thus cherishing blood by what has been especially created by nature to warm blood, we repair to the cold ground for succour! From its produce we pick cotton and hemp, nourished by a circulation of *sap*; and commit the unnatural error of clothing ourselves as vegetables instead of as animals!" Then follows a strenuous defence of woollen clothing, to which, in the long run, all classes of people are compelled to have recourse. And, by way of climax, we are assured that a sinner doing penance in a hair shirt enjoys better health than a saint in a lawn one.

Far be it from us to disparage broadcloth and flannel for backs apt to ache with rheumatism, or even to insinuate anything against a Kilmarnock nightcap for venerable heads, especially if denuded of hair. But, with all deference to Sir Francis Head, we venture to submit that much may be said in praise of linen; and, with the help of Mr Warden's admirable work, and of information derived from other sources, we doubt not that our farming friends, however fond of "the woolly people," will be led to doubt whether they do well in neglecting the cultivation of flax, and in annually

* 'The Linen Trade, Ancient and Modern.' By Alex. J. Warden, Merchant, Dundee. London: Longman & Co., 1864.—'A Series of Letters on the Improved Mode in the Cultivation and Management of Flax.' By James W. Dickson. London, 1846.

spending enormous sums in importing from foreign countries material for rearing animals which may readily be found at home. Mr Warden's book merits their special attention, and not theirs only, but that of all interested in our national prosperity. The manufacturer and the agriculturist will find it full of matter specially bearing on their respective callings. The merely literary student, also, will be attracted by its multifarious topics, embracing things new and old. Nay, we know a young lady who seized on it with avidity, charmed, probably, with the sections, "Ancient Linen," in which "Bible Linen," and the Fine Linen of the Egyptians, figure conspicuously, and "The Linen Manufactures of the Olden Time," in which we have a pleasant account of the primitive customs of our forefathers, some of which lingered on to no very distant date.

Mr Warden thinks that the history of civilisation, as exemplified by the progress of the arts and sciences, should interest us more than the recorded exploits of those who, in popular esteem, are the heroes of our age. Assuredly, Milton had reason to denounce them as "destroyers rightlier called, and plagues of men." It is to be regretted that manufactures, trade, and commerce are only mentioned incidentally by ancient authors, and that few of them give an intelligible account of the manufacture of linen. Most praiseworthy, therefore, is Mr Warden's endeavour to gather into a connected history notices scattered through detached sentences and paragraphs. Animated by enthusiasm for his subject, and anxious, doubtless, to rise to the height of his great argument, he commences with this high-flown exordium: "Since the days when the children of the Nile first learned to spin and weave the world-renowned Linen of Egypt, many revolutions and mighty changes have happened on the earth's surface. Men have risen from obscurity to greatness, have exchanged the shepherd's crook for the kingly sceptre, have graced a throne, and died. Monarchs, who marched with triumphant legions through subdued kingdoms, and wept because they had no more worlds to conquer, had at last to yield to a greater conqueror, and go down to the grave, leaving only a name and fame behind. Dynasties, which for ages dazzled the world with their prowess and glory, at last waned and disappeared for ever. Mighty nations have been born, attained manhood, lived to a good old age, passed away, and been forgotten. Not so the manufacture of linen. It has outlived the reign of kings, it has survived the fall of nations, and while warriors have come and gone, this useful art, this gentle handmaid of industry and skill, remains with us still."

We confess to feeling a little alarm at the prospect of perusing more than seven hundred pages of such *fine writing*. When people are in search of information or amusement they don't care about stilted composition; and those conversant with ancient history are rather astonished to be told that "monarchs have wept because they had no more worlds to conquer." They have, it is true, heard that

this folly was ascribed to Alexander the Great ; but, knowing that he was a man of ungoverned passion, and addicted to the bottle, they charitably conclude that on the occasion so often referred to he must have been "*greetin' fou* ;" and that it is rather hard measure to kings in general to implicate many of them in the folly of one inebriate potentate.

This little blemish, occurring in the first page of the work, is apt to create an unfavourable impression on the critical reader. It soon disappears, however, and Mr Warden handles his pen with a grace and a freedom which render unnecessary his deprecation of criticism on his work as a literary effort. We shall give a *résumé* of its multifarious contents, and then invite our agricultural readers to settle the question whether they do well in omitting flax from their rotation of crops. It used to be largely grown in Scotland, and the enlarging growth of it in Ireland demonstrates how important it is there deemed as a branch of rural industry.

When we have traced the growth and manufacture of flax from the time when "*Eve span*" (a fact in the history of our great ancestress authoritatively declared by the poet), we shall be the better entitled to ask our agriculturists why they no longer grow that species of crop which was, not very long ago, abundantly grown on Scottish soil, and which still flourishes in many parts of Europe.

Though "the spider may be regarded as the earliest spinner on this earth," Mr Warden will not venture to affirm that its web conveyed to Adam the idea of a woven fabric as a substitute for "that first naked glory." And, with all his enthusiasm about linen, he is constrained to admit that wool was probably the material first used for human clothing, when the migration of man to a clime less genial than that of Eden compelled him to adopt other vestments than those supplied by "fig leaves." Though there be no mention of linen in the antediluvian ages, "there is little doubt that it was then known and used. It is certain that it was known and manufactured at a period not long subsequent to the flood, and, therefore, it is very likely to have been known and in use before that event occurred." This is rather a loose way of fixing chronologically the epoch when linen began to be known, and we must add that we should hesitate to affirm with Mr Warden that the veil of Ruth was made of linen ; and still less able are we to give implicit credence to the assertion that when old Isaac blessed Jacob, declaring "the smell of my son is as the smell of a field which the Lord hath blessed," this would seem to imply that "the garment was made of linen, which is the produce of the fields, as to none other could the expression used be so applicable." Neither must Mr Warden be offended when we hold it apocryphal that the vestures with which Joseph was arrayed, through the munificence of the grateful Pharaoh, "were probably a kilt, with a large full shirt over it," and that "both articles were composed of fine white linen."

Not in the least open to scepticism are his observations on the fine linen so profusely employed by the Hebrew priesthood, and in the magnificent furniture and fittings of the Hebrew sanctuary. We fear, however, that the Bishop of Natal will not allow that "the Israelites had constructed in the wilderness looms and all the other necessary implements and machinery for the articles required for the tabernacle, and other such purposes." Whether Dr Colenso demurs to the possibility of this statement or not, it is certain, we believe, that "all the women who were wise-hearted among the Israelites did *spin with their hands*, and brought that which they had spun, both of blue, and of purple, and of scarlet, and of fine linen, an offering unto the Lord" (Ex. xxxv. 25). Philo of Alexandria says "the Jewish high-priest wore a linen garment made of the finest byssus, which was a symbol of firmness, incorruption, and of the clearest splendour, since fine linen is most difficult to tear, is made of nothing mortal, and becomes brighter and more resembling light the more it is cleansed by washing."

And the general use of linen by the mass of the people must have been promoted by the law of Moses, which prohibited the Israelites wearing garments of linen and wool, which, according to Maimonides, was to prevent idolatry, as heathen priests wore such mixed garments, hoping that a lucky conjunction of the planets might bring down a blessing on their flax and their sheep.

Mr Warden briefly states that "Solomon imported linen yarn from Egypt, and it is added, the king's merchants received it at a price." This incident is thus narrated: "And Solomon had horses brought out of Egypt, and linen yarn: the king's merchants received the linen yarn at a price. And a chariot came up and went out of Egypt for six hundred shekels of silver, and an horse for an hundred and fifty: and so for all the kings of the Hittites, and for the kings of Syria, did they bring *them* out by their means" (1 Kings x. 28, 29). In our article, "Horses, Ancient and Modern" (Journal, March 1861), we quoted this passage in order to prove that while Solomon (B.C. 1015) paid about £18, 15s., the Indian Government in 1860 was paying £20 for horses imported from Egypt. We are satisfied that horses alone are referred to, and that it is a mistake to suppose that Solomon imported linen yarn from Egypt.

Mr Dickson is quite at sea when fancying that the wise King "wished to make manufactured goods one part of his exports, by entering into a league with the reigning Pharaoh to receive *linen yarns* at a stipulated price, or, as the words may be rendered, at a fixed duty." He then proceeds to eulogise Solomon as an enlightened advocate of free trade.

We have taken the trouble to look at the passage in the original Hebrew, and in the Greek translation of the Septuagint, and are satisfied that Solomon, though, for political reasons, a great dealer in horses, had nothing to do with the linen trade of the Egyptians.

Flax was indigenous to his own kingdom, and ages before this period his people were expert in manufacturing it into linen, so that he was not likely to be an importer of "*linen yarn*." Moreover, the word *koh* or *koa*, so rendered, is nowhere else thus translated. The Septuagint and the Vulgate give it as a proper name (*Coa*), and the passage under discussion should be rendered thus literally, "And the going forth of the horses which was Solomon's out of Egypt and from Coa; the king's merchants received them from Coa at a stated price." The word *coa* in Scripture invariably means to twist or bind, as a rope, from an Arabic word of like meaning. Hence Mr Taylor, editor of Calmet, conjectures that horses being taken to market attached to each other by cords, "strings of horses," are referred to in the passage, 1 Kings x. 28, which for so long, but, as we believe, most erroneously, has been translated "*linen yarn*." There are in Hebrew words which mean linen and fine linen respectively, and we have searched Gesenius's Hebrew Lexicon without finding the slightest authority for *coa* having reference to *linen*.

"The ordinary clothing of the Hebrews was a coat or waistcoat, and a cloak. The coat was of linen, and the cloak of stuff or woollen cloth, and the Hebrews never changed the fashion of these garments. It is probable, therefore, that the same description of dress which was worn by them when they first entered into the Promised Land was continued till the time of the Babylonish captivity." Mr Warden, reflecting on these his own words, will hardly, we presume, persist in maintaining that the ordinary dress of the Jews was for so long a period composed of "*linen yarn*" imported either from Egypt or any other quarter.

We are at a loss whether to understand Mr Warden literally when thus expressing himself: "It (linen) has continued in use till now, and while time lasts it will continue to be a favourite dress with many people. Nor will its use cease when time has passed, as the last mention of linen in the Bible is in reference to the glorious hereafter—to the heavenly Jerusalem."

Now, Mr Warden, being orthodox, believes that hereafter we are to have glorious spiritual bodies; that we are neither to marry nor to be given in marriage, but to be like unto the angels. Why, then, express himself as if expecting hereafter a body one of whose comforts, or ornaments, shall we say, is literal clothing in "fine linen, clean and white"? No doubt he subsequently remarks, "In heaven, for want of a brighter and cleaner object familiar to man, the righteousness of saints is said to be fine linen. Fine linen is thus a token of purity on earth, and an emblem of glory in heaven." Very true; but how is this emblematical linen reconcilable with the material fabric which will "not cease when time has passed"? If linen, in the literal sense, is to be worn hereafter, the Dundee manufacturers may well be excused for speculating

where it is to come from. Being truly desirous to treat serious matters with becoming reverence, we are vexed at being obliged, in consequence of Mr Warden's allusions, to speak of them thus. In truth, we are of opinion that a good deal of the chapter on "Bible Linen," and especially the concluding page of it, is out of place. We do not quote it because deeming it much too theological either for this Journal or for "The History of the Linen Trade."

Singularly minute, curious, and interesting, is the chapter on Egyptian Linen: "Egypt holds the first place in the production of linen. The flax plant, matured by the fertilising slime annually spread over the country by the Nile, grows there in perfection. The various processes employed in the preparation of the plant in Egypt are admirably depicted on the enduring walls of their ancient palaces, temples, and tombs, by the skilful hand of the artist. Drawings of the various implements employed, of the people in the act of sowing the seed, pulling the plant, carrying water to fill wooden vats, evidently for the purpose of steeping the flax, putting it through the several processes requisite to produce the fibre, spinning it into yarn, and weaving the yarn into cloth, are all distinctly portrayed. Thanks to the dry, pure air of that celebrated country, many of the sketches look as bright and fresh as if they had only yesterday got the finishing touches from the artist, instead of having been painted 2000 or 3000, and, in some instances, even 4000 years ago."

"In Egypt flax is sown, at the present time, about the middle of November, in the plains which have been inundated by the Nile, and is pulled in about 110 days. The cultivation of the plant, the pulling, and steeping, were all carried on very much as at present, and not very different from the mode practised in this country. The scutching process appears to have been done by beating the straw with a mallet to break it and loosen the fibre, and then by driving off the schive with a knife, comb, or other instrument. After being scutched it was combed or heckled to break open or split open the fibres, and to remove the loose fibres or tow, after which it was ready for spinning. This was done by the distaff and spindle, nearly in the same way as was practised in this country not a century ago. The looms for weaving the yarn into cloth were of a comparatively rude construction, and not well adapted for producing a uniformly fine texture, but the industry and the skill of the Egyptians overcame all difficulties, and enabled them to weave even the finest qualities both of plain and figured fabrics in their simple looms."

Bearing in mind the extreme tenuity of the hand-made yarns of the modern natives of India, and the gauze-like fabrics produced by their simple looms, we need not be incredulous when informed that some specimens of Egyptian linen were termed "woven air;" and that some of the linens wrapping up the embalmed bodies of kings

and queens are found to be so fine that the very finest cambric or linen of the present day looks coarse beside these specimens of the Egyptian looms in the days of the early Pharaohs. The most remarkable piece of fine linen is one found near Memphis, of which Mr Warden thus writes: "To the touch it is comparable to silk, and not inferior in texture to the finest cambric which has yet been made. Some idea may be given of its texture from the number of threads in the inch, which are 540, or 270 double threads in the warp, and only 110 in the weft. The perfection of its threads is equally surprising, as the knots and breaks seen in the finest cambric are not found *on holding it to the light*." Then follows what leads us to fear that we have heard a true report that "in Dundee there is little Latin and less Greek." "This was a mode of proving fine cloth known to, and practised by, the ancients. It gave rise to the beautiful Greek expression signifying 'Lincere,' borrowed from test of light; and it is far superior to the Latin *Lincerus*, derived from honey, *Line cerá*" (pp. 164, 165).

Having met with many typographical errors in his work, we charitably looked in order to ascertain whether in a list of *errata* Mr Warden had amended this tissue of blunders. It is not corrected, however; and, therefore, not having quite forgotten our Greek, we presume to inform Mr Warden that he will find it very hard to convince us that "the beautiful expression signifying 'Sincere' is of *Grecian* origin. We know that Sincere is from the Latin *sincerus*, that is, according to etymologists, *sine cerá*, not "derived from honey," but from having no *wax* from honey. And, making use of an expression of Seneca (*De Irá*), we beg to assure our "Merchant in Dundee" that this correction is "*castigatio sincera*," i.e., unmixed with passion or anger, and with the sole motive of convincing "The Dundee Chamber of Commerce" that they might do well to give a little more encouragement to the acquisition of classical learning. Having the pleasure of knowing some of its leading members, and admiring their intelligence and enterprise, we are not without hope that something will soon be done to revive the ancient fame of the Grammar School of Dundee as a seminary of classical learning; now depreciated unduly by an excessive use of the vernacular touching "jute" and "flax and tow," and "codilla of hemp and flax." The noble liberality of Sir David Baxter in founding scholarships in connection with the University of Edinburgh will surely find imitators among those who, in the spinning and power-loom works in Dundee and Lochee, have embarked a capital which Mr Warden estimates at £2,000,000. Doing this their memories shall live more securely than if their embalmed bodies, wrapped in the finest of linen, were deposited in monuments high as "The Law."

This recalls the ancient Egyptians and their grave-wrappings, which in Europe were till lately believed to be cotton, though the

unscientific natives of modern Egypt declared them linen. Mr Bauer of Clitheroe, who experimented upon about 400 specimens of mummy-cloth, Mr Thomson, Dr Ure, and others, have by means of the microscope demonstrated that the sepulchral raiment of the Egyptians consisted wholly of linen. The fibres of linen invariably present a cylindrical form, transparent and articulated, or jointed like a cane, while cotton fibres offer the appearance of a flat ribbon, with a hem and border at each edge.

In these days of mixed stuffs the microscope may most usefully be called into play in detecting adulterations, not only of food—of meal, for example, that staple of the Scottish labourer's diet—but also of dresses. And having accidentally become aware of the fact that jute is employed in the making of silks—very well to look at, but most unthrifty in the wear—we counsel our fair as well as our farmer friends to ward off shams from the outer woman and the inner man by having recourse, not to “a detective,” but to a microscope, that wonderful revealer of secrets!

The use of linen for grave-clothes must in Egypt have been promoted by the prohibition to bury any one in a woollen garment, in consequence of its engendering worms; and this explains why the mummy-cloths of even the poorest are of linen. That some would have used cotton, if permitted, is evident, because thus they would have avoided the trouble of carefully darning their old linen. Generally the bandages are of new linen from the web; but some bear evident marks of careful mending. And old napkins, shirts, and other articles of clothing, are often found in the mummy-pits; a proof this of Egyptian parsimony towards the departed, or of enforced economy doing its poor best to honour dear lost ones.

The quantity of linen anciently required in Egypt for the dresses of the living and for the mummifying of men and animals—such as cats and bulls—must have been prodigious. The linen taken from one mummy, including the outer sheet, weighed 29 lb., and the total length of the pieces was 292 yards. The breadth varies from a few inches to two or three feet, and the length from two or three yards up to six, eight, or nine yards. So enormous is the accumulation of linen in the mummy pits and sepulchres, that European speculators have entertained the project of collecting it for the purpose of making paper.

In the College of Surgeons, Mr Warden mentions that curious specimens may be seen of the different kinds of bandages and coverings enveloping the mummies. In one of them were found no less than seven qualities of cloth, varying from fine muslin to coarse sailcloth.

In modern linen, the proportions of the warp and weft are nearly equal. But, probably from the difficulty and tediousness of putting in the weft when the shuttle was thrown by hand, the warp in the old Egyptian linen sometimes has twice as many threads in an inch as the weft; sometimes, and not seldom, four times the number.

This linen has furnished curious illustration that "there is nothing new under the sun." In an action in the Court of Common Pleas in 1821, the defendant, charged with the infringement of the plaintiff's mode of weaving canvass, asserted that the patentee's manner of doubling the thread was not new. A witness was called who maintained, amid the incredulous laughter of the court, that it was practised for upwards of 2000 years. His irresistible proof was a piece of cloth from an Egyptian mummy, spun and twisted exactly as described in the plaintiff's patent.

These wonderful handicraft-men of old Egypt had attained great perfection in the art of making gold thread, the fineness of which is illustrated by the exceeding delicacy of the numerous figures of men and animals worked in gold on the linen corslet of Amasis. They also at a very early date manufactured carpets, made like Brussels, tapestry, and other carpets of the present day. It also appears from Herodotus, that the idea of mosquito-curtains is borrowed from the ancient Egyptians. We wonder if they knew how valuable is turpentine as a defence against these tormentors, which so often harass our hay-makers, grouse-shooters, and anglers. Let all such persons seek sure defence in a few drops of turpentine rubbed on the parts assailed. For the benefit of our agricultural friends we add, that vinegar is not to be despised for the like purposes. We have known a band of haymakers fairly put to flight, till rallied under the protection afforded by vinegar.

Such was Egypt when leading the van of civilisation; now the basest among the nations: all is changed, even though signs of reviving national vigour have begun to appear since the time of the late Mehemet Ali. The cultivation of flax is entirely in the hands of the Government, which draws a large revenue from the unskilled labour of the peasantry, as yet only imperfectly acquainted with the details of flax culture.

We have only touched on a few of the curious matters so amply illustrated in the long chapter on Egyptian linen, and regret that we must pass over all that Mr Warden has so industriously compiled regarding Phœnician, Carthaginian, and Babylonian, Colchican, Grecian, and Roman linen, in order that we may arrive at the linen manufacture of the Olden Time in this country. This portion of the work is the production of William Miller, Esq., banker, formerly of Dundee, who generously handed over to Mr Warden the MS. of a long-projected work on the Linen Trade, the publication of which has been hindered by serious illness.

Omitting much very interesting matter, we pass on to the seventeenth century, which was prolific in Acts of Parliament intended to encourage the growth of flax and the manufacture of linen, both in England and Ireland. The importation of these articles was prohibited; and at one time the wearing of French cambric was forbidden under heavy penalties, because the House of Commons

thought trade with France detrimental to this kingdom! "It was, indeed, more than time for England to interpose, and save the almost expiring liberties of Europe," quoth Anderson in his 'History of Commerce.' In order to appease the selfish jealousy of the English nation, the Houses of Parliament induced William III., in 1698, to make this promise—"I shall do all that in me lies to discourage the woollen manufacture in Ireland, and to encourage the linen manufacture, and to promote the trade of England."

Strange to say, the Irish Legislature agreed to the compact, and imposed heavy duties upon the export of all woollen cloth. The consequence of this was that this manufacture was completely ruined; and the whole kingdom was reduced to the utmost poverty and distress. On the other hand, and for the carrying fully out of this strange compact, an Act was passed in the following year, 1699, for the special encouragement of the Irish linen trade. A board was established in Dublin called "The Trustees for the Linen and Hempen Manufactures," and certain yearly revenues were assigned to them. This board continued to hold the absolute control of every department of the linen manufacture till the year 1828, when it was for ever swept away, with all its grievous restrictions and monopolies. That it accomplished much good in the infancy of the trade cannot be doubted; but its cumbersome and irritating and inquisitorial interferences were not suited to the genius of the nineteenth century; and so "The Board of Manufactures for Ireland" was numbered with many other antiquated barbarisms of an unenlightened age, which the superior knowledge of the last fifty years has "decently interred."

A Board of Manufactures for Scotland was established in 1727, and, as an example of political shortsightedness, it is amusing to read that by the Treaty of Union between England and Scotland (anno 1706) it was stipulated that certain annuities should be paid out of the imperial purse, and applied for the benefit of the latter country as an equivalent for the greater advantages likely to accrue to England from the said treaty! In this stipulation originated the Scottish Board of Manufactures. The distribution of £2650 allotted to the linen trade embraces £1500 as premiums for growing lint and hemp seed at 15s. per acre; £150 as encouragement to schools for teaching children to spin lint and hemp; £200 as prizes to housewives making the best piece of linen cloth. In these our times, when our ears are deafened with the whirr of thousands of steam-driven spindles, it is passing strange to think of premiums to spinning-schools, and to our great-grandmothers for their home-made linen. The whirligig of time spins us along at an amazing rate. Though born in a large county town, we distinctly remember that our household servants had so little to do of an evening that their leisure was devoted to the spinning-wheel, and this was little more than forty years ago!

The natives of "Auld Reekie" will read this with interest: "Immediately after the appointment of the Board, the trustees proposed to Nicholas D. Assaville of St Quentin, cambric-weaver, to bring to Scotland ten experienced men, with their families, to give instruction in the weaving of cambric. Their proposal having been accepted, the trustees purchased from Heriot's Hospital five acres of ground on which to erect houses for the French weavers. The price was £273, and an inducement to purchase was 'the nearness of the ground to the city, and the villages of Broughton and Coaltown,' from all which they expected apprentices and spinners. It was sold in 1803 to Mr Burn, architect, for £12,000. Shortly after the purchase, in 1730, the name was changed from Broughton Loan to Little Picardy, in honour of the native country of the French weavers. It now wears the more genteel appellation of Picardy Place."

The late Mr Macanlay excited Celtic scepticism and wrath by his graphic descriptions of the wretchedness of the Scottish Highlanders. A report by one of the Inspectors of the Board, in 1754, furnishes abundant evidence of the historian's accuracy. For instance: "In some places they live the whole summer on milk and the blood of their cattle, but have no meal or grain of any kind." "Their clothing is poor like their food, their bodies being seldom covered, and what clothes they have are never changed till worn into rags." "Their houses are extremely mean. Their fire is placed in the middle of the house, around which they put large trees or branches, and behind these they laid heath for beds, where the family sleep promiscuously, few of them having any other covering than their body-clothes." And this was the country which had to be compensated for its union with the ancient realm of England! "Pride brings the world down." In this instance it wellnigh hindered "The Scottish Lion" rising up out of his filthy den, and going forth to feed on the fat beeves of England—far fitter for such a noble animal than the scanty brose of the "Land of Cakes."

The poetry of Burns abounds with allusions to spinning-wheels, rocks and reels, lint and tow.

"I bought my wife a stane o' lint,
As gude as e'er did grow,
And a' that she has made o' that
Is ae puir pund o' tow."

When this unfortunate husband remonstrates with his thriftless wife,—

"She took the rock, and wi' a knock,
She brak it o'er his pow."

The chief localities of the linen trade at the date of the establishment of the Board were in those counties extending from Lanarkshire to Forfarshire, the latter county being even then far ahead of all the others. The Board, so far as the linen trade is con-

cerned, was deprived of its functions in 1823 by Act of Parliament, against which it vigorously protested, declaring the Act fraught with danger to all but a few capitalists, "probably aiming at obtaining a monopoly of the manufactures to themselves." The Act, however, passed at the indignant and reiterated demands of the linen manufacturers, who by experience had learned the worthlessness of bounties and protections which only trammelled the progress of industry; which only craves from Governments freedom to develop its resources naturally, in supplying the growing demands of the populations of the world.

"The first mill for the spinning of yarn by machinery in Scotland was erected at Brighton, near Glamis, in 1790, by Messrs Ivory & Co., relatives, I believe, of the present Lord Ivory," aided by a premium of £300 from "The Board." James Ivory, teacher in the Dundee Academy, a celebrated mathematician, and afterwards knighted, was a partner and manager of the company. For a time it was successful, but on the sudden death of Paul, the Emperor of Russia, in 1801, flax fell so greatly in price, and the company suffered so heavily, that it was dissolved in 1803. The large mill now stands gaunt and bare, surrounded by the unoccupied houses of the workmen, a sad monument of the unstable fortunes of the linen trade.

To a weaver in or near Arbroath, in 1738 or 1739, belongs the credit of having introduced the kind of coarse linen so generally known as "Osnaburgs." Having a small quantity of flax unfit for the kind of cloth then usually brought to market, he made it into a web, which he offered to his merchant at a reduced price. This gentleman, having been in Germany, remarked the similarity between the piece of cloth and the fabric of Osnaburg, and urged the prosecution of the manufacture. The brother of this merchant introduced it into Forfar about 1745, where it speedily became the staple employment of the town and neighbourhood.

Hector Boethius the historian, Principal of King's College, Aberdeen, and a native of Dundee, says of the Dundee of his day (about 1526), "The people travel very painfully about, weaving and making of cloth." As might be anticipated, our "Dundee Merchant" enlarges on the history of the linen trade in this locality, and gives numerous details of great interest to the people of this ancient town, now the centre of the Scotch linen manufacture, and proud of its recently acquired distinction as "the metropolis of jute."* About

* *Jute* is a Bengalee word applied to the fibre of a plant called *Paul*, of the *corchorus* family. It is one of the most easily dyed fibres, and the colours it takes on are bright and beautiful. It is very readily brought to a rich cream colour, either in the fibre, in yarn, or in cloth. It is very largely used in carpet-making; and, being cheap, its products have afforded a ready means for supplying the extraordinary demand for low-class linens. "The consumption of this article has increased enormously," says Mr Warden, "and it may now be called the great staple of Dundee." We have had the greatest pleasure in inspecting one of the largest jute spinning-mills, em-

1792, an unsuccessful attempt was made to introduce flax-spinning by steam-propelled machinery, of about ten horse power. This year there are 160 steam-engines engaged in the staple trade of Dundee and Lochee, of the aggregate of 4621 horse power. The hands employed are above thirty-six thousand; and those engaged in the staple trade are estimated to draw, as annual wages, a million of pounds sterling!

Some idea of the value of the linen trade may be formed from these statements of Mr Warden in reference to the United Kingdom. The quantity exported in 1863 was—linen yarn, £2,535,728; linen, £5,921,308; together, £8,457,036. If the quantity exported be about half the quantity made, this would show the total value of the linen manufactures for 1863 to be about £17,000,000. The value of flax and jute imported, of the hemp imported, which is used in the linen manufacture, and of the flax grown in Ireland and other divisions of the kingdom, 1863, will not be over-stated at £10,000,000. The number of persons employed in the spinning-mills and powerloom factories engaged in the linen trade in different portions of the kingdom in 1862, were as follows:—

England and Wales,	.	.	.	20,305
Scotland,	.	.	.	33,599
Ireland,	.	.	.	23,525
				87,429

The value of the flax plant to the trade and commerce of the kingdom, and as affording employment to large sections of the people, is far from being represented by these figures. Its importance is greatly enhanced by the fact of its seed furnishing a valuable oil, which has the property of drying into a hard transparent varnish. The British farmer is well aware of the fattening properties of linseed-cake made from the seed after the oil has been expressed. He loudly complains, however, that it too often comes to him shamefully adulterated; an annoyance to be avoided by his growing linseed on his own farm, to the benefit alike of his purse and of the animals he fattens for the market. Mr Warnes, writing in 1847, appeared as a sort of God-sent apostle of flax-growing, by means of which he promised "nothing less than complete deliverance from that accumulated mass of pauperism which preys upon the vitals of the nation." And with the help of Mr Dickson, a man of more sobriety of thinking, he succeeded in getting up an agitation in England on "The Flax Cause." His really meritorious achievement was to stimulate many agriculturists to try "box feeding," one great feature in which was the abundant use of flax seed, either green or dried, in the boll, or in the form of linseed-cake home-made, and thus of undeniable genuineness.

playing about 2000 hands, and well deserving a visit from those interested in such matters.

Assuredly, it is not easy to understand the long indifference of the British farmer to the use of a material of such utility in the rearing of domestic animals. In 1861 the importation of linseed oil seed-cake amounted to 79,222 tons, costing £753,397. In the same year we paid £65,230 for flax seed, chiefly for sowing; £3,042,825 for linseed, chiefly for crushing; and £360,520 for oil from seed, chiefly linseed. We have thus an aggregate of no less than £4,221,432 paid for what might have been obtained from home-grown flax. It is some consolation to find that £1,549,796 of this sum was for linseed and linseed oil from the British East Indies.

We have failed to discover in the numerous tables supplied by Mr Warden, equally explicit statements as to the annual value of the hemp-seed imported into the United Kingdom. Its average yield per acre is from sixteen to twenty-four bushels. Its oil is similar in its qualities to linseed, and is largely sold for the feeding of animals.

The indifference of farmers to their own interest, and that of the nation in general, appears yet more strikingly when we reflect on how small a portion of the enormous supplies of flax required by the linen trade is furnished by British industry. In 1862, the computed real value of the imported flax, tow, &c., was . £4,693,928

And of hemp, tow, &c., 1,445,004

6,138,932

Adding the items previously enumerated, amounting to 4,221,432

We have, £10,360,364
 paid to foreigners, with the exception of considerable sums to the British East Indies, and of a trifle to our North American colonies. Now, during the present depressed condition of British agriculture, when wheat, barley, and oats are unprecedently low in price, it is most vexing to find that, for reasons not readily comprehensible, our farmers have reaped a very small portion of the ample returns which foreigners derive from the cultivation of flax and hemp. Though Marshall & Co. of Leeds, and many other distinguished manufacturers, declare their belief that both the soil and climate of England are suitable for the growth of flax, and that at one time the flax grown in the east of Yorkshire was as good as that raised in Belgium, we find Mr Baker, the Factory Inspector, writing thus: "We can neither produce from abroad, nor induce our farmers to grow, the raw material in sufficient quantity. It is to Ireland at present, and even eventually to India, that the flax-spinners are looking for a supply which, if ever the time arrives, is to render the flax trade of comparative importance with cotton. The growth of flax appears to be decreasing everywhere whence we have been accustomed to be supplied. The changes taking place in agriculture, and the diminution of cottar farms, which are peculiarly favourable to flax cultiva-

tion, owing to the cheapness of home labour, and the facility with which flax can be prepared in the first instance, make the matter more important."

Notwithstanding the substantial benefits conferred on Ireland by the linen trade, its extension has not been at all in proportion to the encouragement which it has received. Since the recent rise in price, flax-growing in Ireland has received an evident impulse; and it was estimated that the crop of 1863 would bring in to the growers not less than £4,500,000. And it is believed that this year an area of 300,000 acres was in Ireland devoted to the growth of flax, which, at present prices for seed and fibre, will yield the growers nearly six millions sterling.

In Scotland, flax cultivation seems about to be altogether abandoned. In 1857, Mr Hall Maxwell's statistical returns showed that only 1535 acres were devoted to growing flax.

The interests of the nation, and especially those of agriculture, are so implicated with this state of matters that public attention cannot be too soon directed to it. The soil and climate of the British Islands being confessedly most favourable to the cultivation both of flax and hemp, why should we mainly depend on Russia for our supply of that fibrous material which is to supply us alike with shirts and sheetings for our backs and our beds, and sails and cordage for our ships? If cotton could be produced in Lancashire, would its landowners and farmers not grow it, and so keep in this country the many millions sterling spent in importing it from distant lands? Flax being suited to our British climate, and its growth being amply remunerative when properly cultivated—the best authorities, moreover, agreeing that it may be so cultivated as not to injure the subsequent crops raised in the usual rotations—we are satisfied that the present crisis, affecting alike the agriculturist and the manufacturer, demands that there shall be a careful and immediate reconsideration of the whole question of flax and hemp growing in the United Kingdom.

The perusal of the following extract from the monthly Report of Messrs D. Dewar & Sons, for July 1864, deepens this conviction :—

"We find ourselves in considerable difficulty with regard to the supply of flax. The consumption of linens at home is extending rapidly; it is, in fact, limited only by the supply, for the demand cannot be met; while the value of piece-goods exported during the five months ended 31st May last was £3,138,863, compared with £2,276,878 during the same period of last year.

"According to the result of the most careful inquiry on the part of Mr Baker, 'the average consumption for the last seven years was 100,400 tons,' and of the accuracy of his statement there can be little doubt. He goes on to state that 'the entire acreage of England and Wales is 37,324,883, which, divided into farms, gives an average of 149 acres each, adding the number of farms in Scotland and Ireland; and supposing that every farmer could be induced to grow five acres of flax for one year as an experiment, the produce of a low average rate of 4 cwt. per acre would be equivalent to 511,850 tons. But supposing only half the land or half the inclinations of the farmers would admit of this growth, we should still have a production of

255,725 tons, which would distribute to the farmers themselves between two and three millions of hard cash, which otherwise they would never touch. Moreover, of this we may be sure, that, without this home growth, should there ever be a time when we cannot obtain foreign flax, we shall then have a flax famine, as we have had a cotton famine; and whether there is ever such a time or not, the flax-spinning spindles of the European continent have within these late years so largely increased, that much of the flax grown abroad will be wanted for home consumption; and though we may possibly obtain some of it, the prices will be enhanced, and our own farmers had better, therefore, prepare to help us under the contingency."

The following quotation from the 'Linen Trade Circular,' from D. Dewar & Sons, shows the magnitude of this trade during 1864:—

"The total value of the linen piece-goods exported during the eleven months was £6,993,519, compared with £5,284,413 in the same period of 1863, and with £4,152,725 in the year before. As the accounts for the whole year are not made up, we cannot tell how much the total will be; but we have little doubt that the aggregate value of the flax goods exported will be over £8,000,000, or more than £3,000,000 in excess of the year 1862.

"The home supply of flax was larger than ever known before. Much attention is now being given to the culture of the flax-plant, and people are beginning to find out the value of the crop when properly managed. The total acreage under flax in Ireland in the year just closed was 301,942 acres, showing an increase of 80,843 acres over the preceding year. If we estimate the produce of all this land at an average of $4\frac{1}{2}$ cwt. per acre we shall have an aggregate of 67,937 tons, added to an estimated foreign supply of about 87,350 tons, making a total of 155,287 tons. This is certainly very large when compared with former years, but it is not more than we want were we better provided with spindles to prepare it for the loom."

We are, it seems, likely to have enough of flax. The deficiency in mechanical power for spinning it into yarn will not be of long duration, if we may credit what we have just read of the new process of weaving by means of compressed air. Being acquainted with the application of compressed air in working the coal-mining machines, we should, perhaps, not be surprised by the application to weaving of this comparatively inexpensive motive power. And yet it is surprising to hear of the great probability of steam-impelled shuttles being speedily superseded by those driven to and fro by a pneumatic impulse—the result of which is, considerable gain in simplicity of mechanism, rapidity, and quality of production. The increase of speed is said to be equal to the addition of one-third to the quantity of fabric produced. Assuming the advantage to be only one-fourth, this would give, taking the average production of a loom at 222 yards per week, or 11,100 yards per year, an annual increase of 2800 yards for each pneumatic loom. If applied to the 500,000 looms in the United Kingdom, this calculation represents an aggregate of not less than 1,400,000,000 yards of woven fabric, or sufficient to put a yard-wide girdle thirty times round the world! So that, let our farmers grow immensely larger crops of flax, there seems little reason to apprehend lack of mechanical power to turn them

into linen. If our Scottish agriculturists will alter their "shift" so as to cultivate that textile material for the production of which our soil and climate are undeniably suitable, Ireland shall no longer boast that she is the great producer of that which is converted into lace and lawn for the ladies and bishops, sails for the ships and shirts for the people, as well as sacks for the grain of the United Kingdom.

Of course we are not ignorant of the obstacles to an extended growth of flax, arising from the diminished numbers of the people engaged in agriculture. In this Journal we have frequently called attention to this fact as one of the most important in our social relations. It is now of more importance than ever. Lack of labourers can never be compensated by the application of steam, and the invention of improved agricultural implements.

That something should be done to render us less dependent on foreign supply is evident, if we would escape new horrors, which would fall especially hard on Ireland and Scotland—the chief seats of the linen trade. It is not desirable that we should re-open at present the discussion as to the remunerative value of the flax crop, and its alleged tendency to exhaust the soil. These points are very satisfactorily handled in a highly practical paper which appeared in this Journal of last March, and the perusal of which will, we trust, excite many of our readers to begin forthwith experimenting in the growth of flax. We have pleasure in adding, that in Mr Warden's work they will find brief but clear directions for flax culture, as well as trustworthy statements of its pecuniary value to the agriculturist.

D. E.

RETROSPECTIVE NOTES ON FARM CROPS AND CROPPING.

No. VII.

OF those crops which are grown primarily for their seed or grain and secondarily for their straw, we have discussed those important ones yielding breadstuffs—the wheat, the barley, and the oats—and are now prepared to take up that class of this department of farm produce known by the name of leguminous crops, and of which beans and pease are the most important. The name is derived from the word *lego*, which signifies something gathered by the hand. Of the two crops named above, the most important of the family, we shall take up beans first. The bean belongs to the class of dicotyledonous plants—that is, plants which have two seed-lobes or cotyledons—to the order *leguminosæ*, the family *Faba vulgaris*, and the species generally cultivated in the field is *Faba vulgaris arvensis*; that grown in the garden being called *Faba vulgaris hortensis*; while a third species, very capable of cultivation in either field or garden, is called *Faba vulgaris arvensis vel hortensis*. Not much is known to us about the history of the crop—more, however, relatively than of other crops perhaps, and, at all events, more that is interesting and suggestive. We find mention made of beans in Scripture, and the writings of Roman authors abound in much that is very suggestive respecting them. The crop appears to have had its origin in Persia, from whence it was taken to Egypt, and from thence it spread to Greece and Spain. Egypt for long, however, was the country in which it was mainly cultivated—the rich alluvial soil spreading out on either side of the noble Nile being particularly suited to its habits of growth. The Romans, as will have been gathered from what we have said above, deemed it an important crop, and paid great attention to its culture. Through them it reached this country at a very early period in its history, where it became, and has since continued to be, an important crop. We have said that Roman writers are found to make frequent and singular allusions to beans, and the supernatural qualities they were supposed to possess. Our readers will remember the mysterious precept of Pythagoras, “Abstain from beans;” and the not less mysterious, at all events the very curious, commentaries upon it which have been made by learned writers of the middle ages and of our own times. The Romans seemed, however, to have derived their notions respecting the supernatural powers of the bean, like many other things, from that land of mystery, Egypt, and to have modified them considerably; for while they certainly did attribute very remarkable influence to the beans, and considered it unsafe to have much to do with them as an article of food, the Egyptian priests went much farther, and maintained that it was a crime even to look

at them. Very curious, truly, were the notions current about beans amongst the ancients. They were considered as decidedly opposed to that evenness and tranquillity of mind which with them constituted the *summum bonum*; they were liable, if partaken of by women, to render them barren; they were believed by some to be the residence of the souls of the departed; and, like the scroll of Jeremiah, they were written within and without with lamentation and woe, for their very leaves were supposed to be marked with the words of wretchedness and death. But, notwithstanding all this, beans were largely cultivated by the Romans, and in their writings we can to this day gather much that is really practically useful in their modern culture. Considerable importance therefore, we find, was attached by them to the crop, evidence of which is found in the fact that it gave a name to one of the most distinguished families of the most distinguished period of Roman history; for as we find a family, *Pisanii*, deriving its name from the pea, so we find another, the *Fabii*, deriving its name from the bean.

We have already named the two or three species into which the genus has been by modern authorities divided. Of these there are many varieties. Formerly the vetch was the representative of the bean tribe, and the bean was classed under it as the *Vicia faba*; but the marked distinction between the seeds—those of the vetch being round, while those of the bean are oval and compressed—caused later authorities to class the bean *Faba vulgaris* as a distinct genus. Botanically described, the bean “has the flowers axillary, nearly sessile stalks, with several flowers very short; legumes ascending, termed coriaceous; leaflets elliptical, acute, entire; tendril abortive; stipules half-arrow-shaped, turned at the base; annual, flowering in June and July; stem three to five feet high; leaflets smooth, larger acute at each end, and alternate; flowers from six to ten and more, on a short racemose stalk, white, with a broad, black, velvet-like spot on each wing; calyx whitish, with ovate taper teeth; legume large, thick, oblong, pulpy within while unripe, containing four or five seeds; root tap-shaped, descending with lateral fibres.”

Of the varieties of beans cultivated in this country, the following are the principal:—(1) The “horse” or Scotch, (2) the “tick,” (3) the “Heligoland,” (4) the winter bean. The long-podded beans and the Windsor are more garden than field beans; while the variety known as the Mazagan may be classed, as it has been classed, as an intermediate variety between the short and the long pods, and is adapted for both field and garden. Of the varieties named above, (1) the horse bean is that cultivated in the northern districts of the kingdom, the tick (2) that in the south. The stem of the (1) horse bean is strong and tall, varying from three to five feet in length. Its yield per acre may be set down at four quarters, the weight at 60 to 65 lb. per bushel. The stalk is, in good average growth, well

podded to about the middle of its length, the pods containing usually three, but often four to five beans. The bean is larger than the tick, averaging half an inch in length and three-eighths in breadth. The horse-bean grows well on strong, well-drained, alluvial soils, is hardy, and, as its name imports, is well suited for stable-feeding purposes. The tick is a more prolific variety than the horse, although the stalk is shorter, the pods and the beans they contain smaller; it is also better adapted for lighter soils. The Heligoland (3) is a hardy variety, suitable for the better class of soils in our late districts. The length of the stalk is shorter than of the two varieties above named. The seed is about the same size as the tick. The yield may be put down at from four to six quarters, the weight per bushel 66 to 70 lb. The winter bean (4): this bean is being very rapidly introduced even into the extreme northern districts. It is hardy, prolific, and is capable of being sown in the early winter or autumn, and is ready for harvesting in July of the succeeding year. Another advantage it possesses is its apparent freedom from the attacks of the aphides, that scourge of other varieties of the bean crop. The straw or stalk of this variety is from three to four feet high; the seed is very small, smaller than the tick, but weighs very heavy, 65 to 70 lb. per bushel. Mr Valentine, in his prize essay in the 'Journal of the Royal Agricultural Society,' on the cultivation of beans and pease, states, with reference to the kind or variety of beans he has cultivated, that the horse-bean, the tick, winter, and Mazagan, are the only kinds he has had experience in cultivating. Of these he says that he has found the common horse-bean suited more for heavy clay soils than for light or loamy soils. It requires a firm soil, and runs up to a considerable height. In favourable seasons he has found it more prolific than any other. The English and French ticks Mr Vallentine says he has found to thrive best upon light soils; they grow less straw under similar conditions, yet the grain per bushel weighs some pounds more. On foul land, he says, it is better to grow the tick variety than those varieties which run more to straw. Of the winter beans the French and Russian are those of which Mr Vallentine has had experience, and of these he prefers the Russian, as being rather larger in size and affording a heavier yield per acre. As to the comparative merit of the winter and spring varieties, this authority states that he sees no decided advantage in sowing winter in place of spring beans; but when the condition of the labour or work of the farm admits of it, he would prefer to sow winter beans. At the same time, he would not interfere with the sowing of the wheat in order to get the winter beans in. In any case he says that winter beans should never be sown unless the land is clean, or nearly so, as the autumn ploughing assists the spread of conch much more than if ploughed for spring beans at a later period of the year. Mr Crothen, in his prize essay in the 'Journal of the

Bath and West of England Society,' gives some interesting information as to the intermediate Mazagan and the long-podded varieties, Windsor and the like. Of the Mazagan—so called from the Portuguese settlement of that name on the Morocco coast near Gibraltar—he states that it is hardy, well-flavoured though small; of the Lisbon variety, like the Mazagan, that it is well-flavoured and very fruitful. The Long Pod is, he says, perhaps the greatest bearer of all; it grows about three feet high, is hardy, and of easy cultivation. The Spanish bean, otherwise known as the broad Spanish, is a large bean. It excels in fruitfulness, as does also the Sandwich bean, which, although large, is not a delicately-tasted bean. The White Blossom—so called as it does not bear the black velvety spot already referred to as a characteristic feature of the bean-flower—is good and hardy, although liable to degenerate. It is very late, and may be sown even at the beginning of June. Of all the large varieties none are so highly esteemed as the Windsor, long celebrated for its richness. The varieties best adapted for an early crop are the Mazagan and the Lisbon; they may be sown in October or early in November. In procuring seed, that brought direct from Lisbon late in the season should be preferred, as it will be more fruitful, and produce an earlier crop than the seed grown at home. Mr Crothen notices one variety—the green Genoa bean—of which he says a peculiarity is, that “if permitted to be perfectly ripe before they are pulled, and then be well dried, they may be kept in prime condition for winter use;” and “if steeped for some days before they are wanted, they will become tender, and retain their colour and summer flavour.”

The soil best suited for the bean crop is the strong and rather moist one, firm in texture, yet which is such as to enable the plants to send their roots deep into the soil. Lime is an essential element in it.

As regards the condition of the soil necessary for the bean crop, Professor Tanner, in the able paper to which we have in the course of these papers so frequently referred, states that it requires a soil of a strong and adhesive character; and this as much, in fact, for the supplies of food which it draws from it, as from the mechanical qualities which such a soil offers to the plant. Like the wheat crop, the bean requires a firm condition of land, the roots enabling it to penetrate deeply into and take hold of the soil; hence the necessity there is for allowing the soil to get well settled after it is cultivated before the seed is put in. To secure this the land should be ploughed early if possible, thus giving a freeness to the upper surface essential for a seed-bed, and yet the solidity from settlement above alluded to. The bean crop is almost always taken from corn stubbles; this should, if possible, be cleaned in the autumn, and the manure should then be spread over the surface, ploughed in as deeply as possible, and left very rough. In this condition it may be left till spring-time. Some prefer the manure to be spread, well rotted, early in

the spring, and then to be ploughed in ; but the Professor states that this does not suit the crop so well as the plan described above ; as the land, by the latter mode, does not have time to settle, and the land below gets too consolidated from the absence of the manure during the winter months. Should the land not be prepared during winter, the seed is often ploughed in without the furrow-slice being broken. The period of sowing extends over February and March ; the earlier, however, the seeding is got through the better for the crop. When the beans are well up the use of the roller is deemed advisable to consolidate the soil and secure a vigorous after-growth. The quantity required in sowing by the drill is four bushels the acre. In sowing the winter crop, the ploughing should be finished by the middle, or at the latest the end, of September, and left a month to settle and consolidate, the land being required in the firm condition already alluded to for the winter-sown as well as for the spring-sown beans. When the ground is firm drill the seed, and at wider intervals than used for spring-sown beans. For the latter, Professor Tanner prefers intervals of 24 or 26 inches between the rows ; double rows at 6 to 8 inches being used, thus—

8	26	8	26	8	24	6	24	6
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While pease, as we shall afterwards see, are grown upon light, beans are grown upon heavy soils ; and if upon light, only as catch or stolen crops. In growing them upon heavy soils regularly they form part of the rotation, as thus :—first year, fallow dunged for wheat ; second year, beans ; third year, fallow. In the excellent essay by Mr Vallentine already referred to, there are some valuable remarks on this part of the subject, of which we here give a *resumé*. Such, as above stated, was the almost universal custom of cropping heavy soils, in which beans formed a constant part of the cropping. The wheat was sown broadcast or ploughed in, the beans treated the same way, and neither wheat nor beans ever received any hoeing or weeding, so that the filthy weedy state into which the land rapidly got may be easily conceived, and even at this day, where the system is still pursued, may yet be witnessed. Mr Vallentine states that this system was very generally practised some years ago in Huntingdon, Berkshire, Bedfordshire, and Buckinghamshire ; but that now, under the exigencies of another system, the naked fallow is rapidly becoming more and more rare. Mr Vallentine's own experience has shown him that it is quite possible to banish the naked fallow altogether from heavy, stiff, clay farms, and yet keep the land clean and free from weeds. The rotation he has found best for such soils which are unsuitable for "roots," or at least unsuitable for their easy and profitable culture, is as follows :—First year, beans, dunged ; second year, barley or oats, with seeds (grass) ; third year, seeds, one or two years according to circumstances ; fourth year, wheat—this being changed into a fifth or sixth course, and alter-

nating oats for barley in the second year. By adopting this rotation the land can be kept clean throughout the whole of it, and in about the same condition for each crop. The wheat and the bean crops require to be drilled and thoroughly weeded, so that the land is left clean for the barley and the seeds; the grass land resulting being of course broken up for the fourth, fifth, or sixth year's crop, which is wheat. On land of a medium texture, Mr Vallentine prefers to take a bean or pea crop only every second course as a substitute for the roots which are taken in the first course, the object being to save manure by curtailing the extent of the root or green crops; the pulse (bean or pea) crop having thus no manure, but following the wheat, oats, or barley, as the case may be.

Land intended for pulse crops should be ploughed as early in autumn as possible, and the drier the soil is the better. The heaviest lands should be taken in hand first. Where the beans follow a grain crop, the manure should be spread upon the stubble during the winter; the carting of the manure can easily be done without injury to the land. This laying of the dung on the surface, to lie for weeks before it is ploughed in, is one of the disputed points in modern farming; but it is right to say that the opinion is becoming very generally held that it is a good plan. Professor Voelcker maintains that there is no loss of manurial substances; Mr Baldwin, on the contrary, maintains, or at least did maintain, that there is. On this point Professor Donaldson refers to the practice often displayed in East Lothian, where the manure is spread along the furrows or deposited in heaps at intervals, and in this way exposed for weeks to rain, wind, and sun, till it is apparently "washed, bleached, and dried;" and yet the crops are equal to those obtained by the usual mode of covering the dung, and even in some cases a certain superiority for the crops so raised has been claimed. Many years, says this authority, have tested the matter, and "however much it may clash with the doctrines of chemistry about exposure and loss by evaporation, such facts are stubborn things." We have seen, however, above, that chemistry, as expounded by Professor Voelcker, is in favour rather than otherwise of the exposure of the dung. The practical authority in the 'Journal of the Royal Society of Agriculture' we have already quoted, is decidedly in favour of the system of carting on the manure to, and spreading it over, the stubble in winter and ploughing it in. He says, that when so applied in winter, and ploughed in, the dung acts to the best possible advantage in every respect on all but the wettest and undrained soils. The manurial substances are absorbed by the soil as the manure decays, rendering also the heavy soils porous by the mechanical admixture of its heavy portions. Moreover, by the application of dung at this season the manure is so tempered that the forcing of the plants, which an authority says results from mixing the fresh manure with the newly-ploughed land in *spring*,

is avoided, and by avoiding this, disease in the crop is not so likely, he thinks, to take place; he believes, therefore, in the "innumerable advantages of winter dunging." The great aim in carrying out a rotation in which the naked fallow is dispensed with, and a succession of crops, with the bean as one of them, kept up and taken off heavy stiff soils, is to keep them clean. To insure this the grain crops preceding the beans should be well drilled, so that horse or hand hoeing, or both, can be done. The beans which follow are of course to be hoed also, the distance between the rows to be regulated according to the condition of the soil. Beans, by a proper system, can be very successfully cultivated as a cleaning crop for heavy soils, however much opposed may be the opinion of some that they cannot. Mr Vallentine's experience shows that they can. The first step in his system is, plough the land as early as possible in the winter, and if this is properly executed no other ploughing in spring will be necessary—on the contrary, it may not even be advisable. In place of a second or spring ploughing, a simple scarifying is all that is needed, and will be found to move the soil effectually where the ameliorating influences of the weather have not penetrated to the depth of four or five inches. Even this scarifying Mr Vallentine has not found necessary, as a working of the heaviest harrows has done all that was required. The object in view in reducing the soil to a proper tilth is to allow the plants to take the greatest possible amount of nourishment from the soil during the period of their growth. Our authority is not, however, an advocate of the system which aims at getting a very finely pulverised condition of soil in spring, before the sowing of the seed; on the contrary, he prefers to get the beans a first start in medium soil, reducing it afterwards by subsequent cultivation, thus at once getting fine tilth and clearing off the weeds. He deprecates, as "most injudicious," the ploughing and scarifying the land to excess in February, for the purpose of pulverising the land, as the same object can be secured, and better secured, after the plants have fairly come up. Great loss arises from the padding of horses' feet in spring, for the dry weather which generally follows renders the soil hard, cloddy, and quite unsuited to hoeing and weeding. Mr Vallentine is no advocate for hand-dibbling of beans at so much per peck, as it is done generally in so slovenly a manner as to cause the beans to come up in such crooked uneven lines as quite to prevent hoeing being properly carried out. He drills his beans in straight lines in spring before the harrow is worked over the land, and across the furrows at an angle, so that the drill itself breaks up the land, the seed being deposited at a depth of four inches, but not less than three. The land is only harrowed once after the beans are drilled, should it not be dry enough to admit of the whole harrowing to be done. In very stiff clays it sometimes happens that the soil becomes all at once finely pulverised as the beans come up; in this case the use of

the roller is to be recommended, as it levels the land, and prepares it for after-harrowing and hoeing. Some object to this rolling of heavy land, but Mr Vallentine has found it beneficial in circumstances as above stated. The same authority believes that beans are much improved by being harrowed about a fortnight after they have come up. If they are very thick on the ground, one harrowing may be given in the direction of, another across, the rows. This will be found very effectual in tearing up the weeds between the plants. Let it be borne in mind, however, that no harrowing should be done in a frosty morning, nor indeed, says our authority, any other kind of cultivation. As soon as the beans have got above ground three inches or so, let hoeing be begun; the sooner this is done, indeed, the better, after the plants are fairly and sufficiently up. The earlier the hoeings, and the more frequent they are, the cheaper each is; the land is kept clearer, and by consequence the value of the crop is increased. It is, says Mr Vallentine, a great mistake to send one or two labourers into a field to clean it after the weeds have grown *above* the plants. It would be well if many farmers would bear in mind what he further says, that if hoeing is not done at the right time there is a "certain useless expenditure of labour" in doing it at the wrong one. The longer the surface of the land is allowed to remain untouched the harder it becomes, and the greater is the difficulty to break it up and get the weeds out. True as this is, however, it should not be forgot that it is equally silly to hoe in wet weather. This only increases the evil; for not only can the weeds not be got up when the soil of stiff heavy clays is wet, but when dry weather sets in the land disturbed by the hoe gets into such a hard cloddy condition that after-hoeing cannot be done, or, if attempted, not done well. All these considerations point to the imperative necessity there is for the farmer to study well the weather, and to lose no opportunity of doing what ought to be done. Let this in the art—for it is an art, as all know who have tried it practically in the field—of hoeing be remembered as an axiom, that the weeds should be kept down by hoeing before they have got strength. But it is better, in fact, to keep them down, as Mr Vallentine says, by hoeing "before they can appear, rather than to kill them when they have attained a certain strength." In no department of farm labour is the force of the proverb so apparent as in that of clearing land from weeds—"a stitch in time saves nine;" "one year's weeding saves nine years' seeding." Mr Vallentine says, and says, we are sure, with perfect and suggestive truth, that he never regretted hoeing any crop too soon, but that many a time he has felt the loss arising from hoeing it too late. Hoeing by hand is esteemed the best, but it must be well done; and to insure this the labourers must be well looked after, for shirking work is as often done in the field as it is in other places. Garretts' horse-hoe is a useful implement, but it should be used before the weeds get so strong and long as to become entangled

in and among the hoes. Our authority states that 8 to 10 acres per day may be ploughed easily by this machine, but when the ground becomes hard and very weedy its use should not be attempted. The common iron plough with its mould-board taken off will be found a very useful implement for hoeing between the rows; doing one row at a time is perhaps the easiest way on soils very stiff and apt to become cloddy and hard on the surface. Mr Vallentine gives the statement of expense of cultivating the bean crop on his system, which it is well to give here:—

One ploughing in autumn (cost per acre),	£0 10 0
One drilling in spring,	0 2 6
Three harrowings,	0 2 0
One rolling if necessary,	0 0 6
One harrowing after the plants are above ground,	0 0 6
Sometimes two harrowings,	0 0 6
One horse-hoeing, say, on an average of seasons by the common hoe or plough, three acres per day—per acre,	0 1 8
Two hand-hoings, just beside the rows,	0 5 0
One more horse-hoeing if necessary,	0 1 8
Total cost of cultivation per acre,	£1 4 4

Mr Vallentine states that by this system of cultivation the land has always been kept clean, and that the crop has *always* been better with much hoeing than with little. By the still not uncommon mode of culture of the bean crop, the following is the expense per acre:—

One ploughing in winter,	£0 10 0
One ditto in spring,	0 10 0
One scarifying,	0 3 6
Four harrowings,	0 2 0
Two hand-hoings, say only	0 7 6
	<hr/> 1 13 0
Cost of cultivation by judicious management,	1 4 4
	<hr/> 0 8 8
In favour of modern system,	

“Such an account,” says Mr Vallentine, “is partly imaginary and partly true, as, where the horse-hoe is not used in many instances after the sowing of the seed, the previous cultivation is the same as the system recommended. On the other hand, instead of 7s. per acre being paid for hand-hoeing, more than double that sum is paid for hoeing and weeding together; and, after all, the land is left in a filthier state after the crop is harvested than before the seed is sown.”

We have already described the different varieties of beans used for seed on farms, and to what we have said we have now to add what is, indeed, most important to be attended to—namely, that the seed to be chosen must be true to its variety and of the best quality, sound, and free from disease. Let not the farmer run away with the notion that any kind of seed will do; on the contrary, let it be retained in his memory as a maxim indisputable, “Bad seeds, bad crops.” As with other crops which we have described, so with the bean crop, change

of seed is good ; that is, the beans raised in one locality may be sown with advantage in another. In all cases it is essential to have seed which has been properly ripened.

The period of sowing spring beans extends from the middle of February to that of March, winter beans from the end of September up to the middle of November ; but, as Mr Vallentine says, the earlier the better. The same authority states that spring beans may be sown from the middle of January to the middle of March, and that it is better to sow any time in February when the land is in good condition, than to sow earlier when it is not. Professor Wilson says, that for winter beans the early part of October is probably the best, as for spring beans February is the best. By the choice of October for the sowing of winter beans the stubbles of the preceding grain crop will have been ploughed and well cleaned—points of vast importance in the bean crop. In the sowing of spring beans, the first fine weather after or about the middle of February should be taken advantage of to get the seed in ; for, as well remarked by the authority above quoted, “ the bean plant requires from six to seven months to complete its growth ; and if the period of sowing is delayed, the harvest operations are necessarily kept back at a period of the year when each day’s delay renders the season less adapted for the purpose, and the stooks are frequently injured before they can safely be carted off the field.”

With reference to this point, as to the best time of sowing beans, does it not, may we ask, appear a strange thing that, with all our agricultural societies, national and district, we are in possession of no well-defined trustworthy results of experiments carefully carried out to decide it ? But we have said so much in previous articles as to the apathy of our agricultural societies on points connected with the culture of our crops, that we need not take up space here by saying more, if indeed saying more would be productive of any utility, which we are shrewd enough, however uncomplimentary to the power of the press it may be, to believe that it would not. It is easy enough to talk of the red-tapeism of our Government—is there none of the disease existing amongst the officials of our agricultural societies ? Be this as it may—and possibly, to their minds, it is a matter not worth a rush—the fact is patent enough that, with the exception of what we learn from the experiments of Arthur Young, now very old—save the mark, what a pun !—we know nothing as to the relative value of different periods of sowing. It will be well to note here the results of these experiments :—

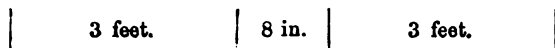
Of seed sown in November	the produce was	.	.	4.00
“ “ December	“	.	.	3.42
“ “ January	“	.	.	4.42
“ “ February	“	.	.	4.49
“ “ March	“	.	.	4.00
“ “ April	“	.	.	2.1
“ “ May	“	.	.	1.42

The quantity of seed per acre to be sown varies with various districts, condition of soil, climate, &c., so that the remark we have had to make in connection with this department of other crop culture we have again to repeat—that no rule can be given applicable to all cases. As a rule, $2\frac{1}{2}$ down to $1\frac{1}{2}$ bushels per acre may be taken as the quantity of winter beans required, while for spring beans from 2 to 4 bushels per acre will be required. The poorer the soil the greater the quantity of seed required.

The modes of sowing the crop, like those of the wheat crop, are three in number, and the same in character—namely, broadcasting, drilling, and dibbling. Of the first of these it is scarcely necessary to state that, with a crop such as the bean, which in one sense is a foul-growing one, it is bad, as where it is adopted it is quite impossible to keep the growing crop from the weeds which so rapidly encumber it. *Drilling* is done by the ordinary grain drilling machine, but with the coulters and seed-spouts made adjustable, so that the necessary distances between the rows may be obtained easily. They should be adjusted to sow the seed at a depth of not less than three inches, but nearer four in the majority of soils. In Scotland, and also in many parts of England, drilling of beans is effected by the bean harrow, doing one row at a time. *Dibbling* is usually done by the hand, and in a very primitive way—a stick dibble being used to make the hole, and the seed dropped in by hand. The work is often done by women and children, and almost always done in a careless slovenly way. The system of getting the work done by paying so much per bushel or peck dibbled in is obviously most absurd, and calculated to leave the way open for all sorts of cheating careless work. Mr Vallentine on this point says, that those who adopt this plan “not only encourage dishonesty, but put a complete check upon cheap and perfect cultivation afterwards.” The same authority states that the opinion so generally held in favour of dibbling arises from a mistaken notion as to its value. He says that he has had both drilling and dibbling done alternately in different fields for some years, and that he never found any difference in the crop but what could be traced to the work in either case not having been properly performed; and further gives it as his opinion that “neither the drill, the dibble, nor the men who use either, can exercise any influence over the crop after the seed is sown in a proper manner.” We are by no means disposed to accept this *dictum* as the right one. What is the proper manner of sowing the seed? It may be by the system of drilling, or perhaps by that of dibbling; it is probable that one is better than the other. There is no doubt that one way of sowing seed—any seed—will be more in accordance with the habits of the plant than another. To say that all plans of sowing are alike good, is not borne out by analogy or by facts, so far as we know and are possessed of them. As dibbling seems, for instance, to be the best mode of sowing wheat, inasmuch as it favours the

after development of the plant more than any other, so do we incline to the opinion that it is equally the best way to plant the bean-seed. Certainly experiments which we have made in the field all go to favour this view, and there was no difficulty in telling which of our crops was the best crop—the drilled, the dibbled, or the broadcasted. So far, then, from agreeing with Mr Vallentine, that the mode of sowing can and does exercise no influence on the after-growth of the plants, we believe that it does exercise an influence, and an important one. Which of all the three ways of depositing the seed is the best absolutely, we are not prepared to say, further than we conjecture that dibbling is the best; but still all circumstances of culture incline us to believe that in this as in other departments the three degrees of comparison exist—good, better, best. It would not form an altogether useless kind of inquiry on the part of the Agricultural Societies of the kingdom to ascertain *which* is the best.

The broadcast system of sowing beans being put out of court, as by almost universal consent the worst, and the drilling and dibbling retained as the two best, the question arises, What are the best distances at which to sow the beans? that is, the distances between the rows. We have already pointed out Professor Tanner's views on this point; but we may say what many of our readers doubtless are well acquainted with, that the greatest possible diversity of opinion exists as to the width between the rows of beans. Some advocate exceedingly wide intervals between the rows—as much as from 5 to 6 feet; others maintain that the closer the distances the fewer are the weeds and the less vigorous their growth. A very usual distance between the rows in the districts—and we may say that they are the most advanced in practice—where the bean crop is looked upon as a fallow or cleaning crop, is 27 inches. The advocates of the wide intervals insist upon the immense advantages of permitting free access of atmospheric influences to all sides of the plant; and they say that this is obtained best by wide intervals. We ourselves have tried almost all possible combinations of intervals, and we have come to the conclusion that the width of 3 feet between the rows, and where the two central rows are 8 inches, gives excellent results. The arrangement is as follows:—



Still more remarkable results, however, have been obtained by gauging the rows a less distance apart—27 inches—but with all the rows single, thus:—



By this arrangement both sides of the plants in the rows receive the full influence of light and air. In some beans we grew upon this

plan the podding was something very remarkable, and all the more so when compared with the double-row system, and still more so when compared with the three-row system. Thus, in the two-row system, $\begin{array}{|c|} \hline a \\ \hline b \\ \hline \end{array} \begin{array}{|c|} \hline c \\ \hline d \\ \hline \end{array}$ the outsides, as $a\ b, c\ d$, get the chief supply of light and air, the inner sides getting much less, and this in proportion the closer the rows were to each other. Make the rows three,

thus— $\begin{array}{|c|} \hline a \\ \hline b \\ \hline \end{array}$ and it is quite obvious that the central row $a\ b$,

gets comparatively little of the atmospheric influences. If any one doubts the astonishing efficacy of a proper supply of light and air in raising the produce of the bean plant, let him sow a patch

of this shape, $\begin{array}{|c|} \hline a \\ \hline b \\ \hline c \\ \hline \end{array} \begin{array}{|c|} \hline b \\ \hline d \\ \hline \end{array}$ and the interior space broad-

cast; he will find that while the interior plants will grow apparently as vigorously as the exterior ones, the podding will be confined almost entirely to the outside plants in the lines $a\ b, b\ d, d\ c, c\ a$. Some successful growers have made the distance between single rows 5 feet, and have been perfectly well satisfied with the results. Perhaps the most complete, if not the most satisfactory, experiments referring to the distances to be given to the rows of beans were those carried out by Mr George Hope of Fentonbarns, of which a very full account will be found in the 'Transactions of the Highland Society' for July 1859, and to which the reader is here referred, contenting ourselves by here simply stating that of the three widths, 8 inches, 16 inches, and 27 inches, the medium width, 16 inches, gave the best results; the space between the widest rows being a mass of weeds, those between the narrow rows being remarkably free from them. Where dibbling is resorted to another question arises, and, like many others connected with the practice of agriculture, it is a disputed one, and it is, What should be the distance between the dibbled pockets, or the beans in the rows? Nine inches is a very usual distance, and we have found it give good, we may say the best, results. Others again, while advocating very wide intervals between the rows, advocate the utmost possible degree of thickness of seeds in the rows. We have tried this close seeding in the rows, but did not find the result at all equal to that obtained by dibbling them at 8 or 9 inches apart. Nor need we be surprised at this, seeing the superior position of the dibbled plants relatively to one another, securing to each plant abundant supplies of light and air.

With reference to the practice of different districts in sowing beans, Professor Donaldson, in the prize essay on beans and pease, in the 'Journal of the Bath and West of England Society,' has some

interesting remarks, of which a *resumé* will be useful here. On the plastic and London clays, broadcast sowing of the crop is imperative, the waxy tenacious nature of the soil preventing all drilling and dibbling being properly and economically done. The crop is thinly planted, and the cleaning is effected by hand-hoeing while the plants are not high; open furrows are left, which renders the operation of hand-hoeing more easy. On soils of this description beans are introduced after a wheat stubble, and followed by a crop of oats, then comes a fallow; by this arrangement the clover crop is taken once only in the eight years, in place of once every four. The farming on such soils as those now under consideration leaves, and, it may be said, keeps the land foul and most displeasing to the eye of one accustomed to another and a better system. The plants being thinly set, the ground is exposed, and becomes rapidly dry and parched, and hand-hoeing, such as it is, is rendered difficult and uncertain; weeds are therefore got rid of with difficulty if at all, and many grow up to seeding. In the best classes of viscous clays of the sort we are now considering, where the original deposits are mixed with chalk and chalky marls, the soil is capable of bearing a thicker-set crop, which proportionately keeps down the vigour of the weeds; nevertheless, even in such lands the farming is foul enough. On the pure clays first named, the average return of the bean crop is 16 bushels per acre, the return on the modified clays, mixed with chalk or chalky marl, 24 bushels. On the pure tenacious clays of the lias, chalk, or Kimmeridge formation, beans are also sown on the broadcast system; but fairly thick sowing is permissible, which tends to keep down the weeds, and, shading the soil, renders it less baked and cracked, and more fitted for hand-hoeing. In some cases a useful purpose is served by ribbing up the land after being well harrowed by a small plough, thereafter sowing the beans by hand, which fall into the furrows and are covered by the harrows. Hand-hoeing can in this system be well carried out. In the modified clays met with in Essex, which have been washed with fresh water, and in this way divested of much of their usual tenacity, beans are cultivated in rows 9 inches apart, from that up to 2 feet—the seed being dibbled in by hand on the top of the furrow-slice, which is made as deep as possible. A light harrowing covers the seed and concludes the operations. This mode is the first departure from the broadcast system, where soils do not admit of being stirred in autumn or in the spring; and where the distance between the rows is as great as 18 inches, the crop can be kept fairly clean by hand-hoeing; but horse-hoeing is scarcely admissible, the hoes not being able to penetrate the soil sufficiently, hardened as it is from the winter furrow, so that it is difficult to obtain a tilth favourable to absorption and evaporation. Scarifying, however, is useful as an auxiliary to the hand-hoeing, as tending to get rid of the surface weeds. Soils of this class being well suited to the bean, give large crops under this

system of culture, from 50 to 60 bushels per acre being not unusual yields.

Where clays, by mixture with chalk, assume a moderately friable condition, the land is deeply ploughed in winter and well harrowed; the beans are drilled by a corn-drilling machine, modified so as to deposit the seeds deeply—the distance between the drills being from 9 to 18 inches; the seeds are covered by a light harrowing. Another method on such soils is to well-harrow them, and then run a light plough up, so as to throw furrows at any desired distance; broadcasting the beans, which fall into the furrows, and are finally covered by the harrow. Both of these modes admit of horse-hoeing or scarifying between the rows in the earlier stages of the growth of the plants, while hand-hoeing can be done.

Where lands are so friable as to admit of autumn or spring preparation, the application of farmyard dung and of wide-interval drilling by machine, the perfection of bean-culture is met with. As the beans delight in a deep though firm soil, the stubble is ploughed in autumn as deep as possible, a depth of not less than 8 inches being aimed at. The ploughing covers in the manure, which in a rotted condition has been laid over the stubble at the rate of twelve cartloads to the acre. As soon as the weather is favourable in spring, and the land in good dry condition, the land is well harrowed, or ploughed, or broken up by the contrary workings of a grubber. It is then turned over with furrows 27 inches apart, in the furrows of which the seed is deposited by drills, and the ridges split by the double-mould-board plough, so that the soil is delivered on each side, covering the seed; or the seed may be sown broadcast, and, falling into the furrows, it is covered with the harrow or by splitting the drills. A light rolling then succeeds, and then a slight harrowing to break up the surface. As soon as the plants are about two inches above the ground, the light plough is sent to take from the sides of the drills a light furrow, reversing it into the hollows. The scarifier is used for the subsequent workings, which are continued as long as the plants permit. After each scarifying hand-hoeing is performed, and this as carefully as possible, not only cutting the weeds on the sides of the drills, but passed between the plants in the drills, so that the weeds are removed and the soil loosened. In some cases the drills are earthed up with a double-mould-board plough. This method now described is carried out on the fen lands and on the deep earthy loams, and forms, says Professor Donaldson, "the most perfect system of bean-farming." Perhaps the finest and most successful bean-farming is met with in East Lothian, where, says this authority, "the deep, loamy, clayey, concreted gravels near the town of Dunbar, and the red rolling clays that overlie the trap rocks south from North Berwick, exhibit the cultivation of beans in a manner that is (elsewhere?) unequalled." Beans here generally follow the oat crop; on this

farmyard manure is spread and ploughed in by the winter furrow. The land is then drilled, turnip-fashion, in spring, the beans sown and covered by reversing the drills, and the after cultivation effected by the horse and the hand hoe. In the most recent practice the land is worked by ploughing and grubbing, the weeds very carefully removed; drills are then opened by the common plough, and farmyard dung spread along the hollows; on this the beans are sown by machine, and the drills are reversed, covering the seed; a rolling levels the drills, and a slight harrowing opens the surface just before the beans begin to show through. When the plants are about two inches high, the small plough drawn by one horse is sent in, and takes a deep furrow from the sides of each drill, sending the soil into the intervals. The drill-grubber is used to stir the soil afterwards, and hand-hoeing is carefully carried out. In some cases the drills are earthed up by the double-mould-board plough.

The same authority, of whose opinions we have just given a *résumé*, has other remarks which it will be useful here to condense. Enlightened practice, he says, recommends the farmyard dung to be used for beans in a highly wetted yet scarcely putrescent state; the roots of the young plants delighting to search for nutrition amongst the rank particles, so that while the tap-root descends the lateral fibres receive plenty of nourishment. Top-dressings of almost any substance are not to be recommended, producing, as they generally do, more top foliage than grain. This tendency is more marked in leguminous than in grain crops. Dissolved bones, lime, gypsum, Glauber salts, common salts, nitrates of soda and potash, have all, he says, been recommended for beans, to be sown on the young plants, and afterwards mixed with the soil by hoeings. Gypsum and lime require a long time for solution, and should be applied to the land before sowing the seed, or the former along with the seed. Lime may be mixed with the soil by hoeing, or laid on the winter furrow or on the surface, and scarified into the soil. Decisive trials are wanting to decide the question between top-dressings of artificial manures and farmyard dung, which appears, however, to be the true manure for the crop. "Top-dressings rather assist a bad than produce a good crop." Beans are an excellent preparatory crop for wheat, and appear to bestow greater benefit upon the land and to take less from it than any other cultivated crop; but to fulfil these conditions the land, says an authority, must be well prepared, and the crop drilled and carefully cleared from weeds; or, if sown broadcast, thick, so as to cover the soil and shade it. Where the broadcasted crop is thin and straggling, low in stature, and puny in growth, the land is exposed and gets hard, rendering not only hand-hoeing difficult, but affording empty spaces in which weeds luxuriate. In clays of the poorest kinds, which will not admit of thick-sown, broadcasted, or drilled crops, beans should be avoided, as they only fill the land with weeds. Beans are often

classed as a green or fallow crop, but they are not strictly so, for they perfect their seeds in the same year in which they are grown; and, in the rotation of modern systems, a green crop is that which does not perfect its seed in the year of its growth, and is that which follows a crop bearing its seeds the same year. The bean, nevertheless, cultivated in the improved modes, of more than one of which we have given description, is still a valuable preparatory crop; it admits of a fair amount of stirring and weeding, and the soil is ameliorated by the action of the tap-roots, which descend into and open it up.

We have already pointed out the physical condition in which the soil requires to be for the bean plant. As regards the chemical condition, being what is called a calcareous crop, drawing much lime from the soil, the great essential is that the soil should have this lime. Hence we have seen that, from the soils formed of clay mixed with chalk and sand, the richest crops are obtained; if, then, lime is absent, or at best but sparingly present, it is necessary that it should be added. Mr Huxtable recommends an artificial manure in which lime is present, and which is as follows:—2 bushels of lime, 2 cwt. of superphosphate, 5 bushels of salt and ashes. Mr Crothen, in his prize essay in the 'Bath and West of England Society's Journal,' states, that if the land has been limed, the farmer had better depend upon some nitrogenous substance as a top-dressing; and for this purpose he says nothing is better than guano at the rate of 3 cwt. to the acre. If this cannot be easily obtained, apply 20 or 30 bushels of soot with 3 or 4 bushels of salt. As regards the after-culture of beans, all that has to be said is simply this, that on the plants reaching that height which prevents the working of hand or horse hoes, the crop is left to itself to take its chance. What this chance is we shall now briefly examine.

The first enemy, the attacks of which the bean has to contend against, is the "millipedes," which commence to eat the seed-bean almost immediately after it has been put into the soil. The attacks of these insects are either so complete as entirely to destroy the germinating power of the seed, or to weaken it so much that the plants resulting are weak, and liable either to be killed by frosts, or to be particularly obnoxious to those diseases, or to the attacks of the insects which infest the crop at a later period of its growth. The names of the millipedes which thus attack the seed-beans shortly after being put in the soil are, the *Iulus pulchellus* and *Polydesmus complanatus*, of the habits of both of which a full account will be found in vol. v. p. 228 of the 'Journal of the Royal Agricultural Society of England.' The seed-beans are much more liable to be attacked by the millipede in cold and wet seasons than in comparatively warm and dry ones. Should the seed-beans committed to the soil fail to be attacked by these millipedes or false wireworms, and make such progress as fairly to appear above ground, they have to "run the

gauntlet" of another and a different set of enemies, not less powerful, however, for evil; these are the weevils, so called. The weevils, or beetles, belong to the order *Coleoptera*, and to the family *Curculionidæ*, and the species which attack the beans was called by Linnæus *Curculio*; but it is now, as stated by the able entomologist Curtis, comprised, along with some twenty other beetles, all scourges of garden and of farm crops, under the genus *Sitona*. The species called by Linnæus *Curculio* is now named *Sitona lineata*. These weevils, or bean-beetles, are of the same colour as earth; and this, in conjunction with their habit of falling from the leaves of the plants when disturbed during the day-time, and remaining, with their limbs folded up, quite motionless on the soil, renders it an exceedingly difficult task to discover them at work. They either destroy the plants as rapidly almost as they appear above ground, or erode or gnaw away the edges of those leaves which may have been developed before their attacks commenced. The weevils burrow in the soil during the dark, generally commencing their attacks shortly after daylight. The end of March is the period in favourable seasons when they commence their attacks, but more usually it is April before they appear with all their destructive force. Hence may be deduced the practical suggestion, that the stronger we can have our plants at this season, the more likely are we to find them able to withstand their attacks. Comparatively little is known of their habits, so that not much progress has been made in the discovery of a remedy or a means of preventing their attacks. From the hard horny nature of the covering of the insects, it is obvious that no external application made with a view to destroy them could be made without also destroying, at the same time, the plants upon which they feed; hence the only resource left open to us is rendering their food so unpalatable to them, by some simple application to it, as to drive them, as Mr Curtis says, "to forage elsewhere." This is done by dusting wood-ashes, soot, or lime over the plants early in the morning, when the leaves are damp or wet with dew. Our readers may remember, perhaps, that Mr Fisher Hobbs recommended a similar remedy for the prevention of the attacks of the turnip insect or fly. Mr Curtis also points out how a catch-crop may be made by leaving some of the rows undusted, and when the weevils rush to these in numbers, as to new feeding-grounds, and their presence is made thoroughly manifest by the erosion of the leaves, the whole army of insects might be destroyed by pouring boiling water over the plants, thus saving the general crop. The same authority also mentions the fact of a very eminent agriculturist having, with great success, adopted the plan of harrowing or hoeing the plants, doing either the one or the other of these whilst the dew was upon them, so as to cover the leaves with soil, and thus destroy the food of the weevils.

If the plants escape the attacks of the millipedes or the weevils, and reach the more mature stage when flowers appear, with these also appear the other insect enemies—the humble-bee and the aphides, or plant-lice. Bees are often quoted as friends to man, bearing the pollen of male plants to the ovaries of female ones, and thus rendering them more prolific. While this is true enough of them in some, nay, in many cases, it is not so in the case of the bean-plant. The bean-flowers are greatly injured by the humble-bees—order *Hymenoptera*, family *Apidæ*, genus *Bombus*, and the species *Bombus terrestris* and *Bombus lucorum*—which operate upon them “by puncturing the base of the flowers, and rendering the incipient pod entirely or partially abortive.” “The cause,” says Mr Curtis, of the humble-bees “thus damaging the crops of beans and flowers arises possibly from some unusually large female—for individuals of the same species vary greatly in size—not being able to creep into many flowers that are too small to admit of their bodies, and too long to allow of their reaching the nectary with their tongue; they are not, however, to be thus balked of their feast, and instinct directs them to the exact spot on the calyx beneath which the nectar is stored. There they nibble with their strong jaws until they are enabled to introduce their proboscis and obtain the desired treasure.” Humble-bees form their nests in old walls, and amongst heaps of building rubbish; they collect moss in summer-time for the making of their nests, and the females come out in spring to collect the honey and pollen. The destruction of the bees, if desired, should thus be carried out in summer. The bees have many enemies—as the butcher-bird amongst the feathered tribe, and the fly *Volucella inanis*, and the caterpillar of a moth *Ilythia colonella*, amongst insects; of these the latter is the great destroyer of the bees.

The great insect enemy of the bean crop in its later stages of development is the Aphis or plant-louse. These belong to the order *Homoptera*, family *Aphides*, genus *Apis*, and species *Scopoli*, vulgarly known as the collier-fly, the black fly, or the black dolphin. The appearance of these minute insects is generally very sudden, and their ravages not only complete if not arrested, but remarkably rapid. By very fortunate circumstances their presence is easily detected; and this not only from their intensely black colour, but from their always appearing at the upper part of the plant. To meet the attacks of this insect the farmer has fortunately a remedy not only easily carried out, but most effective: this is topping the plants, either by cutting them off by means of a scythe or sickle, or by hand. Care should be taken to carry out this remedy on the very first appearance of the insect; hence the necessity of a watchful supervision of the bean-field; and, further, to destroy the cut-off heads, either by burning them, which is the best method, or by crushing them into the soil with the foot as they are cut off. The

insects or lice are eaten in immense numbers by the lady-birds, and their black larvæ by ichneumons and maggots of dipterous flies ; but while the number of the aphides may thus be kept under by these enemies, it is doubtful whether this conduces to the safety of the crop, inasmuch as the remedial measures, if they are designed to be perfectly efficient, must be taken at the very earliest stage of the attacks of the aphides.

Beans are also subject to the attacks of another species of beetle named, but named erroneously, bugs. These belong to the order *Coleoptera*, family *Bruchidæ*, and genus *Bruchus*, so called from their "distinctive nibbling propensities." The eggs of the insect are deposited in the flowers of the bean, and the maggots result ing from these eat their way into the seed. Before changing into the pupa condition, the maggot eats a round hole from its cell to the rind of the seed. The rind at this part is also probably "partially cut through," so that when the beetle is ready to come out of its cell, it readily forces itself through the rind. Fortunately the maggots do not destroy, as a rule, the germ of the seed, although often they do so completely eat all the interior, that nothing is left but a hollow case or rind. To kill the maggots, therefore, the beans used for sowing are recommended to be steeped in lime or in hot water for a minute or so before sowing. Mr Curtis states, that "seed should be examined before sowing, and the infested beans may be detected by dull circular spots on the skins where no holes are to be found." Another insect which attacks beans in common with corn and other vegetables, is the mole cricket. This belongs to the order *Orthoptera*, family *Achetidæ*, genus *Gryllotalpa*, species *Gryllotalpa vulgaris*. Residing under the surface like a mole, it burrows horizontally, and has astonishing muscular powers. It commits its ravages upon the crops in the night. The only plan recommended to the farmer on the large scale, is that quoted by Curtis as adopted by Kellar. "Where there is a flat area of 500 or 600 yards, dig three or four pits, in September, 2 or 3 feet deep, and a foot wide ; then fill them with horse-dung, and cover them over with earth. Attracted by the warmth, all the mole crickets will resort to these pits from the surrounding neighbourhood in the first frost, and may then be easily destroyed." It is a singular and fortunate circumstance, that although most prolific, their disposition is so ferocious that the mother devours nine-tenths of her offspring. The mole is also one of their greatest enemies. Their presence in soils may be detected by the little heaps of earth thrown up by them in their progress.

While, as we have shown, a good deal is known as to the habits of the insect enemies of the bean crop, little comparatively is at the service of the farmer as to its diseases. The plants are liable to be attacked by a parasitic fungus termed mildew, this being more the case when sudden variations of temperature act in conjunction

with cold and wet weather; and in cold, undrained, heavy clay soils. A fungoid disease which has been recently attacking the bean crop will be found very fully described by the eminent entomologist, the Rev. M. J. Berkeley, in the 'Agricultural Gazette,' p. 677, vol. for 1859. The leaves are covered with red and brown and snuff-coloured blotches, which are, in fact, due to the *uredo fabæ*. The plants sometimes recover from the attacks of this disease, even after it has been so far developed as to give the crop "a very wretched aspect." Another disease has been described by the same authority as affecting the pods of the bean. Although at first it is confined to the surface of the pod in the form of a scab or pustule, it has been found to eat its way through the pod and attach itself to the seed, which becomes deteriorated in value.

THE ARAB HORSE OF AFRICA.*

WE are about to give our readers some new notions regarding the origin and treatment of the noblest of our domesticated animals, the horse. Our information is derived from a singular book, the most remarkable portions of which are furnished by the Emir Abd-el-Kader, whose protracted resistance to the French in Algiers, followed by long captivity in France, excited such compassion, and whose release, opposed by politicians for reasons of public security, was at length effected by personal appeals to the generosity of the Emperor.

The book is not only interesting in itself as a valuable contribution to the natural history of the horse, it also possesses a peculiar charm to the philosophical student of human nature. Its main subject, no doubt, is the *genus equus*; but, quite unintentionally on the part of the French general and the Arab chief, the *genus homo* stands out prominently, and under aspects so diversified as to afford a most striking exhibition of the many-sidedness of the human being as modified by climate and religion—those influences which so powerfully affect his physical condition, and the extent of his mental development.

The brave, temperate, half-religious, half-fanatical Man of the Desert, and his chief friend the horse, are brought into sharp contrast with the equally brave, but the much less self-denied, and the much less religious, Man of Europe, in the person of a distinguished

* 'The Horses of the Sahara, and the Manners of the Desert.' By E. Daumas, General of Division commanding at Bordeaux, Senator, &c. &c. With Commentaries by the Emir Abd-el-Kader. Translated from the French by James Hutton. W. M. H. Allen & Co., London, 1863.

French general, familiar with the civilisation and learning of his own intelligent nation, and patriotically seeking to turn to its advantage the valuable knowledge acquired during a long residence in Algeria.

Our readers will readily understand the sort of contrast afforded by the respective views of persons so differently trained as a French officer and an Arab chief. Their mutual relations, moreover, have in them something touching. The exiled Arab is politely requested, by an agent of the power which had crushed him, to furnish information regarding the most valued animal of the desert; the object being to supplement works in which General Daumas had served the interests of France by throwing light upon important questions of war, commerce, and government. The Emir, complimenting him on his thirst for knowledge, replies—"You ask me for information as to the origin of the Arab horse. You are like unto a fissure in a land dried up by the sun, and which no amount of rain, however abundant, will ever be able to satisfy. Nevertheless, to quench, if possible, your thirst (for knowledge), I will this time go back to the very head of the fountain. The stream there is always purest and freshest. Know, then, that among us it is admitted that Allah created the horse out of the wind, as he created Adam out of mud. Several prophets—peace be with them!—have proclaimed what follows: When Allah willed to create the horse, he said to the south wind, 'I will that a creature should proceed from thee—condense thyself!' and the wind condensed itself. Then came the angel Gabriel, and he took a handful of this matter and presented it to Allah, who formed of it a dark-bay, or a dark-chestnut horse, saying, 'I have called thee horse—I have created thee Arab—I have attached good fortune to the hair that falls between thy eyes; thou shalt be the lord of all other animals; men shall follow thee whithersoever thou goest. Good for pursuit as for flight, thou shalt fly without wings.'"

And then, by a most curious process of reasoning, the Emir proceeds to demonstrate that Allah created the horse before Adam, and the horse before the mare! His proof of the latter fact is accompanied by an assertion of such practical importance that it deserves notice. "My proof is that the male is more noble than the female, and he is, besides, more vigorous and patient. Though they are both of the very same species, the one is more impassioned than the other, and the divine power is wont to create the stronger of the two the first. What the horse most yearns after is the combat and the race. He is also preferable to the mare for the purposes of war, because he is more fleet and patient of fatigue, and because he shares his rider's emotions of hatred or tenderness. It is not so with the mare. Let a horse and a mare receive exactly the same sort of wound, and one that is sure to be fatal, the horse will bear up against it until he has succeeded in carrying his master far from the field of

battle ; while the mare, on the contrary, will sink at once upon the spot, without any force of resistance. There is not a doubt on the subject ; it is a fact known by proof among the Arabs. I have seen frequent instances of it in our combats, and have experienced it myself."

It is this singular mixture of fanciful reasoning with practical knowledge that makes the Emir's commentaries so worthy of observation. Dismiss his "proof" of the horse being created before the mare, cavalry officers will yet do well to remember the positive assertion of the gallant Emir as to the greater power of endurance characteristic of the horse ; and it is equally obvious that it ought not to be forgotten by the gentleman following the hounds, seeing that the integrity of his neck so often depends upon the pluck and bottom of his steed ; and it is also to the interest of the agriculturist that he should bear in mind the greater vigour ascribed to the horse.

In France, assuredly, the fact appears to be considered deserving of attention ; for, in the old days of the diligence, who does not remember the neighing of the stallions by which it was generally drawn ? and we have a vivid recollection of the number of horses in the cavalry regiments of France.

But while the book abounds with striking contrasts between the horse and his rider in Europe and in the African desert, the greatest novelty to many a reader is the political and religious aspect of the horse among Mussulmans. We prize the noble creature for his physical qualities, as well as for his mental endowments. We know his worth as our ally in peace and in war ; and his social instincts induce us to be with him on terms of friendliness. The gift of a valuable horse is deemed worthy of the acceptance of the mightiest kings, in symbol of homage or of friendship. And thus the Queen of Great Britain has from time to time received presents of their finest horses from the chief rulers among the nations. When, in 1860, the Emperor and Empress of the French visited Algiers, the various tribes, whose long resistance had yielded to the persevering assaults of the French, were assembled to do homage to the Emperor, the chiefs, clad in their richest dresses, alighted from their steeds, and advanced in a body to present the richly caparisoned *horse of homage*.

Though we know all this, and are aware that the British is the most equestrian nation in the world, most of us will be surprised to learn that, in the faith of Islam, the horse is invested with a kind of sacredness which has signally advanced the purposes of Mohammedan ambition. The Jewish lawgiver, with the design of confining the Hebrews to Palestine, and preserving them a peculiar people, expressly forbade the multiplying of horses, or the fetching of them from Egypt ; so that, when we read that Solomon had "40,000 stalls of horses for his chariots, and 12,000 horsemen," we know

that he was transgressing the Mosaic precepts, even as when he took unto him "seven hundred wives and three hundred concubines" (1 Kings xi. 3).

Mohammed, on the contrary, a great military genius, and bent on the aggrandisement of the Arab race, inflamed their passion for fleet steeds and fair women, and adroitly contrived that horses and houris should become at once potent instruments of religious propagandism and political ambition. All nations and governments have regarded the horse as one of the prime elements of their strength and prosperity. The Prophet of Mecca had the sagacity to make him a principal agent in these furious irruptions of the Arabs which have left such permanent effects upon many of the kingdoms of Asia, Africa, and Europe. With the keenest appreciation of his value in war, he adopted the subtlest expedients to make it subservient to his purposes. "In the days of paganism," observes Abd-el-Kader, "they loved the animal from motives of interest, and merely because it procured them glory and wealth; but when the Prophet spoke of it in terms of the highest praise, this instinctive love was transfigured into a religious duty." When, in token of submission by the five tribes of which Arabia then boasted, five magnificent mares were presented to the Prophet, "it is said that Mohammed went forth from his tent to receive the noble animals, and, caressing them with his hand, expressed himself in these words, "Blessed be ye, O daughters of the wind!" Afterward the messenger of Allah said, in addition,— "Whosoever keeps and trains a horse for the cause of Allah is counted among those who give alms day and night, publicly or in secret. He shall have his reward. All his sins shall be remitted, and never shall fear dishonour his heart."

A volume might be filled with phrases from the Koran, the traditionary sayings of the Prophet, and the commentaries upon them, all inculcating the love of horses as a religious duty.

The believing Emir, for prudential reasons probably, appears to be blind to the political results of this religious equestrianism. Not so is General Daumas. With the clearest insight into what Mohammed proposed to himself as a great conqueror, he maintains that it was essential that the horse should be looked upon in the light of a sacred animal, a providential instrument of war, created by the Deity for a special purpose, and of a nobler essence than that of which he fashioned the other animals. As the result has proved, he herein showed himself thoroughly acquainted with the temperament of the people who were to be the instruments of his soaring ambition. Reversing the exclamation which Shakespeare puts into the mouth of King Richard, he might have said, A horse! a horse! a horse for my kingdom! This policy had sense in it. To worship sacred bulls as the Egyptians did, and the Hindoos do to this day, is a foul degradation of the human intellect, bringing with it no

conceivable benefit by way of compensation. Hence while with Milton we scorn fanatic Egypt—

“Likening his Maker to the grazed ox,”

we see so much method in Mohammed’s fanatical propagandism by means of the sacredness he associated with the horse, that we cannot possibly regard him as a moon-struck dreamer. No, verily! with the hoof of the horse he has left his ineffaceable mark upon the human race.

If, then, we desire to be acquainted with the early history of this precious quadruped, to know its capabilities, and be familiar with the treatment of it by the people who love it most and understand it best, we must talk with the Arab in his tent, and wander with him in the desert.

The Arab and the Desert, to which we are introduced by General Daumas and Abd-el-Kader, demand a few words of explanation.

The *man* is the descendant of those colonists of the Arab race who permanently settled in Africa during the fifth and sixth centuries. The *region* into which, eventually, they have been driven is the Sahara or *Great Desert*, strictly so called, seeing that it is the most extensive on the surface of the earth—its area being estimated at 2,500,000 square miles, or two-thirds that of Europe. For hundreds of miles the eye only rests on bare sands in flats and hillocks, or on naked and rocky tracts, destitute of vegetation, and seldom exhibiting any of the forms of animal life. Nevertheless the Sahara contains numerous fertile tracts (*oases*), watered by perennial springs, and containing a numerous population, consisting of two nations of Berber origin (the most ancient inhabitants of North Africa, according to some, and descended from the Phœnicians), but divided into numerous tribes, all Mohammedans. The *fauna* of the Sahara is as deficient as its *flora*; and, notwithstanding the frightful heat during the day, the nights, owing to excessive radiation, are so cold that ice is frequently formed.

In this sterile region there are patriots and poets and warriors, all ready to die for fatherland, and calling on the nations of the earth to believe that they are the people favoured of Allah!

Our learned Emir can wield the pen as well as the sword; and aspiring, mayhap, to be the poet-laureate of his tribe, he indites a poem in which we are told—

“Two things are beautiful in this world,
Beautiful verses and beautiful tents.”

Addressing him who condemns the love of the *Bedoui* for his boundless horizons, our poet asks—

“Is it for their lightness that thou findest fault with our tents!
Hast thou no word of praise, but for houses of wood and stone!
If thou knewest the secrets of the desert, thou wouldst think like me;
But thou art ignorant, and ignorance is the mother of evil.”

And then, after a description of the natural features of the Sahara, and the stirring incidents of desert life, comes the proud boast—

“We are kings. There is none to be compared with us.
Is it life to undergo humiliation?
We suffer not the insults of the unjust. We leave him and his land;
True happiness is in wandering life.”

We are very willing to believe it; and seeing that General Daumas declares that there is a striking resemblance between the horseman of the Sahara and the knight of the Middle Ages, we are surprised that many more of our wealthy British travellers do not visit Algiers, with the intention of making a brief sojourn among the singular people inhabiting the not distant Sahara. Our invalids begin to appreciate the charming climate of Algiers, where the seasons glide into each other imperceptibly, the range of the barometer being only from $29\frac{1}{8}$ inches to $30\frac{1}{8}$ inches—the whole cycle of the weather's changes indicated within the range of $1\frac{3}{8}$ inches! What a contrast to the turbulent mutability of a climate like ours! We experience what the Germans call a *sehensucht* for a land where the trees bud in February and the fruit is ripe in May, which also is harvest-time.

And should we ever enjoy the equable temperature of the Barbary States, and take a peep at the genuine Arab chief in the Sahara, we shall doubtless experience his proverbial hospitality; though, by the way, we are startled to find among the schedule of his effects only “three wooden platters for strangers to eat from.” We have no notion what they are like, but comfort ourselves with the belief that they must be tolerably big, inasmuch as they are priced 13s. 6d.—rather a large sum in the desert, where coin is so scarce. Should our wife accompany us, it is manifest that the loss of any of her multifarious raiment will not be readily replaced; for the four wives of our desert host and the two wives of his two sons have only, General Daumas warns us, one haick a-piece, one pair morocco-leather boots, embroidered (price 4s. 6d. *each*—we like to be precise when writing for the ladies). *Chemises* and *chemisettes* being nowhere in the inventory, we fear our “second self and mysterious double” will not at once take into her loving arms her Arab sisters, even though assured that the lack of clean linen is by them supposed to be more than compensated by their being each the possessors of two pairs silver ear-rings set in coral.

As to our creature comforts, we are in hopes that they will not be neglected, for our Arab host's property is estimated at £5121. He will, moreover, have time to make himself agreeable, for all he has to do is to attend the meetings of his tribe, ride about, look after his flocks, and pray.

It is quite a mistake to fancy that in the desert every man has a horse, and that walking is at a discount. The poor Arabs are astonishing pedestrians, and, as special messengers, think themselves

well paid with four francs for going sixty leagues. In the desert such a messenger travels day and night, and sleeps only two hours in the twenty-four. When he lies down he fastens to his foot a piece of cord of a certain length, to which he sets fire; and just as it is nearly burnt out the heat awakes him. General Daumas relates that one of these men, the bearer of an important message, travelled about 120 miles in sixteen hours, eating during the journey only a few dates, and drinking about three and a half pints of water. So that the British pedestrian through the Sahara, if such a personage shall appear, bent on "astonishing the natives," will require to step out briskly in order to accomplish his amiable project.

As our compatriots, when in foreign parts, are accused of "coming it grand," and of trusting to the imposing effect of their sturdy *physique*, we beg quietly to give them the hint that the Arabs laugh at braggadocio airs, and are not at all impressed by lofty stature and bodily strength. Their esteem is bestowed on activity, address, and courage. Looking at a burly fellow whose praise is being sung, they may be heard whispering, "What to us is the stature or the strength? let us see the heart. After all, it may only be the skin of a lion on the back of a cow."

But we must not dwell on the manners of the desert—we especially wish to tell about its horses.

The horses of the Sahara are of especial interest, not only on account of their intrinsic merits, but also because of the comparative accessibility of their *habitat*. If to Europe the infusion of Arab blood has been an undeniable improvement in the breed of our horses—if it be still acknowledged that the thorough-bred horse of Arabia is a most desirable acquisition—the question immediately occurs, Where may he be most readily procured? The answer must be, From north Africa—the Barbary States, Algeria—regions to us much more accessible than the desert of Arabia or our empire in India, where the breeding of horses is systematically prosecuted by Government.

And to repair to these regions we have the additional inducement derivable from the fact emphatically asserted by Abd-el-Kader, and assented to by General Daumas, that the horse of the Sahara—the Barb—is the veritable horse of the Orient, identical with the horse of Arabia, brought into Africa by the ancient race of the Berbers.

It is through the French in Algiers that we may chiefly hope for supplies of this valuable animal; but not even through them, without infinite trouble, and very possibly only of an inferior type, and from an Arab compelled by poverty to part with an animal which is his own friend, and the friend of all his family, petted and prized alike by old and young.

Allah has said—"The horse shall be cherished by all my ser-

vants, and none will I place on his back save those who know me and worship me." The Mussulman princes have availed themselves of this politico-religious dogma to prohibit the sale of Arab horses to Christians under pain of sin and damnation. The Arab's love of money cannot be gratified by the sale of a really valuable horse; his whole tribe would resist it. And so, if the repute of the Arab steed among us be not so high as once it was, the explanation is, that the horses and mares of the highest order are never parted with to foreigners at any price. In a recent article in the 'Edinburgh Review,' entitled "English Horses," the writer not only asserts that in India the Arab is confessedly inferior to the English racer, but thinks it probable that, owing to the intercourse between Arabia and India, and the high prices for horses at Calcutta and Bombay, the very best horses that Arabia produces are to be procured in India.

But, in opposition to this, we repeat that religion and policy require of the Arab chiefs that they shall exclude infidels from the possession of their noble breeds of horses. When at the height of his power, Abd-el-Kader inflicted death without mercy on every believer convicted of having sold a horse to a Christian. In Morocco the exportation of this animal, so valuable as an instrument of war, is hampered with such restrictions that the permission to take it out of the country is altogether illusory. At Tunis the same reluctance only yields to the imperious necessities of policy; and in like manner at Tripoli, in Egypt, at Constantinople—in short, in all Mussulman States.

General Daumas asserts—"I know for a fact that, in certain Mussulman countries, in the list of obligatory presents for a Christian personage, the donor wrote down, 'a jade for the Christian.'"

To French *politesse*, *finesse*, or light-fingeredness, or to French success in war among the tribes of the desert, must we look, then, for pure specimens of the horse, which the Arab identifies with himself and his religion.

"The love of the horse," General Daumas writes, "has passed into the Arab blood. That noble animal is the friend and comrade of the chief of the tent. He is one of the servants of the family. His habits, his requirements, are made an object of study. He is the burden of their songs, the favourite topic of conversation. It is thus that the Arabs acquire that knowledge of horse-flesh which we are so astonished to meet with in the humblest horseman of a desert tribe."

In regard to their belief that in intelligence the horse approaches the nearest to man, the General asks, "May it not be that the Arabs, by living on such intimate terms with the horse, have succeeded in developing faculties the very existence of which is unknown to us, who accord to that animal only the instinct of memory?"

At all events, it is manifest that Arab notions regarding horses are worthy of attention, and that special respect is due to the opin-

ions of Abd-el-Kader, because of his exalted rank in Mussulman society, and his science and skill as a horseman. As we have already said, he insists on the fact that the horse of Arabia, and the Barb or horse of north Africa, are identical. Moreover, the Barbary horse, so far from degenerating from the Arab, is actually his superior, and is the very perfection of a war-horse. The French in Algiers have good reason for being of the same opinion. A *chasseur d'Afrique*, setting out on an expedition fully armed, takes with him coffee, sugar, beans, rice, pressed hay, barley, for five days, along with four horse-shoes, and several things besides, so that the total weight carried by his horse is twenty-five stone; whereas the English light dragoon, accoutred in marching order, weighs nearly nineteen stone. So that well may General Daumas exclaim—"A horse that, in a country often rough and difficult, marches, gallops, ascends, descends, endures unparalleled privations, and goes through a campaign with spirit, with such a weight on his back, is he, or is he not, a war-horse?"

If the Barb should be welcomed by our cavalry regiments, he is also possessed of such speed as to make him an acquisition to our racing studs. A Barbary horse, rode by the owner, M. F. de Lesseps, was the winner at the races at Alexandria in 1836, to the surprise of the Viceroy of Egypt, who had been bantering M. Lesseps on the arrival of a horse sent to him from Tunis.

The fame of the Barb was established in England long ago, for Markham, in 1593, writes thus:—

"Next the Turke I place the Barbarie: they are beyond all horses whatsoever for delicacy of shape and proportion; they are swift beyond other forraign horses, and to that use in England we only employ them; yet are their races only on hard ground, for in soft or deep ground they have neither strength nor delight. Their colours are for the most part gray or flea-bitten."

This remark of Markham as to the general colour of the Barb is a proof that the best specimens of the animal were unknown in England.

"Allah created the horse *koummite*—red mixed with black—that is, dark bay or dark chestnut." This, then, is the colour preferred by the Arabs, and General Daumas agrees with them in this preference. Mohammed and Moussa, the celebrated conquerors of Africa and Spain, must, he argues, have had thorough knowledge of the superior value of the chestnut-coloured horse; and their opinion being that of all the Arabs likewise, it is entitled to respect.

"If," he observes, "it be true that those whose coat is red shaded with black are endowed with superior speed, are we not justified in inferring that such was the uniform colour, such the natural qualities, of the sires of the race? I submit, with all humility, these observations to men of science."

"The Emir, moreover, assures us that it is ascertained by the Arabs that horses change colour according to the soil on which they are bred. Is it not possible that, under the influence of an atmosphere more or less light, of

water more or less fresh, of a nurture more or less rich, according as the soil on which it is raised is more or less impregnated with certain elements, the skin of the horse may be sensibly affected? There is perchance, in all this, a lesson in natural history not to be despised; for if the circumstances in which a horse lives act upon his skin, they must inevitably act also, in the long-run, upon his form and qualities."

To sum up Arab sense and nonsense as to colour: the fleetest of horses is the chestnut; the most enduring, the bay; the most spirited, the black; the most blessed, one with a white forehead. "Flee the piebald like the pestilence, for he is own brother to the cow." The Isabel, with white mane and tail, no chief would condescend to mount such a horse. Some tribes would not allow him to remain with them a single night. The Prophet abhorred a horse that has white marks on all its legs.

"A horse with white feet, his off fore-leg being alone of the colour of his coat, resembles a man who carries him gracefully in walking, with the sleeves of his coat floating in the air." But to this *dictum* of the Emir we oppose that of the very clever author of 'Adventures of a Gentleman in search of a Horse':—

"A dark hoof is preferable to a white one; the latter is more porous in its structure, and more liable to become dry and brittle. This is easily demonstrated by soaking two hoofs of opposite colour and equal weight in water. The white hoof will become heavier than the other when saturated, and will become dry again far sooner. It is also quite notorious among farriers that when a horse is lame, having one foot white and the other black, the disease is generally found in the white foot. So common is this prepossession against white feet, that I have known instances of them being stained by chaunters; but while I admit that a preference is due to the dark hoof, I cannot say that I would reject him for the want of it."

We must allow our readers to decide whether, in the matter of the colour of a horse's foot, they shall side with English blacklegs, *alias* chaunters, or with the Emir of the African desert.

The late Lord Chancellor Campbell wrote a book demonstrating that Shakespeare was learned in the law; and, more recently, Bishop Wordsworth has done the like to prove that he was a good Christian and an orthodox divine: a horse-dealer may with equal truth make it clear that he was very knowing in horse-flesh; for has he not drawn this portrait of a horse as he ought to be?—

"Round-hoofed, short-jointed, fetlocks sharp and long,
Broad breast, full eye, small head, and nostril wide,
High crest, short ears, straight legs and passing strong,
Thin mane, thick tail, broad buttock, tender hide."

It is curious to contrast Shakespeare's *beau idéal* of a horse with that of an Arab of the desert:—

"A thorough-bred horse," says Abd-el-Kader, "is one that has three things long, three things short, three things broad, and three things clean. The three things long are the ears, the neck, and the fore-legs; the three things short are the dock, the hind-legs, and the back; the three things broad are the forehead, the chest, and the croup; the three things clean are the

skin, the eyes, and the hoof. He ought to have the withers high and the flanks hollow, and without any superfluous flesh. The tail should be well furnished at the root, so that it may cover the space between the thighs; the tail is like unto the veil of a bride. The eye of a horse should be turned as if trying to look at its nose, like a man who squints. The ears resemble those of an antelope when startled in the midst of her herd. The nostrils wide: each of his nostrils resembles the den of a lion; the wind rushes out of it when he is panting. The cavities in the interior of the nostrils ought to be entirely black. If they be partly black and partly white, the horse is only of moderate value."

We pray our readers to note that the Arabs never mutilate their horses as too many of us still do. Their ears and tails are left as nature made them, on the propriety of which primitive treatment we cannot do better than quote from that most wise and witty book, 'The Horse and his Rider,' by Sir Francis B. Head:—

"About forty years ago it was the general custom to dock the tails of all hunters, covert hacks, and waggon-horses so close that nothing remained of this picturesque beautiful ornament of nature but an ugly stiff stump, very little longer than the human thumb, which, especially in the summer-time, was seen continually wagging to the right and left, in impotent attempts to brush off a hungry fly biting the skin more than a yard off. At about the same period an officer in our army took to the Cape of Good Hope a gentle, beautiful, thorough-bred mare, which, to his astonishment, the natives seemed exceedingly unwilling to approach. The reason was that her ears had been cropped; and as among themselves that punishment was inflicted for crimes, they were induced to infer that the handsome mutilated animal had suffered from a similar cause—in fact, that she was *vicious*."

But if a Mussulman think it a profanation to dock the ears and tail of a horse, what would he say of the ignorant barbarity of too many Christians, who actually inflict blindness on the horse by extirpating the *haw*—that curious appendage to the inner angle of the eye of a horse, which consists of a dark membrane, whose rapid transit over the eye, apparently at the will of the animal, cleans the eyeball of dust or other particles? When this membrane is slightly inflamed, and thus more prominent than usual, most country farriers cut it off as a diseased excrescence. And so wide is the delusion, that, in the Encyclopædia of Rees, under the article *haw*, this important membrane is described as a diseased tumour in the eye, and instructions are given for removing it!

We beseech all farriers and horse-fanciers to remember that it is shameful to be ignorant of the physical formation of the most prized of domestic animals. "Sidi Aomar, the companion of the Prophet, hath said, 'Love horses; tend them well, for they are worthy of your tenderness. Treat them like your own children; nourish them like friends of the family; clothe them with care. For the love of Allah do not neglect to do this, or you will repent of it in *this house and in the next*.'"

The races of the horse most esteemed by the Saharenes are three; of these that of the Hâymour, the foal of the onager or wild ass—so called because a celebrated mare, abandoned as being seriously

hurt, is believed to have been covered by a wild ass (*hamar el oudhhch*). "Whoever," says the Emir, "has seen the horses of that breed will not for a moment question the truth of the tale, for their resemblance to the zebra strikes every eye." This is a curious illustration of the value of the French experiments in hybridising, explained in our recent article on the acclimatisation of animals.

The Arabs affirm that the best age for reproduction is from four to twelve years as regards the mare, and from six to fourteen as regards the horse. They agree with British breeders in believing that the foal receives more of its characteristic qualities from the horse than from the mare; hence their proverb, "The foal follows the stallion," who also is believed to transmit his moral qualities. "The noble horse," said the Arabs of old, "has no vice."

Stallions, however, are rare in the desert, and belong only to the principal chiefs, who can afford to have them properly looked after, as it would be dangerous to turn them loose on the grazing grounds. The Arabs generally prefer mares, because, in the time of war, they do not betray their movements by neighing like the horse, and are, moreover, more easily kept. In the value of the mare as a breeder they have an additional reason for this preference. Hence they exclaim, "A mare that produces a mare is the head of riches;" and with perfect truth, seeing that from three to four thousand pounds have been received for the offspring of a single mare.

The foaling exhibits certain Arab peculiarities. The instant the foal is dropped it is taken up in the arms of one of the bystanders, who carries it up and down in his arms for a considerable time, in the midst of almost inconceivable din, purposely made under the belief that, after such a horrible uproar, it will never afterwards be frightened at anything! This lesson over, the master of the tent places the right dug of the mare in the foal's mouth, and exclaims, "May Allah bring us good fortune, health, and abundance!" All his friends respond, "Amen! may Allah bless thee! He has sent thee another child."

Besides teaching the foal to suck its dam, it is speedily taught to drink camel's and ewe's milk, because it can thus be left in the tent when the mare is again put to work, and because, in default of water, it will in after life be satisfied with milk instead, not only as drink, but as food, should barley run short.

The weaning is generally in the sixth or seventh month, when the women take possession of the foal, saying, "It belongs to us now; it is an orphan, but we will make its life as pleasant as possible." And they do. The women and the children play with it and pet it, feeding it with a sort of semolina made with wheaten flour, as well as with bread, milk, and dates; and to their gentle handling the Arab horse is doubtless indebted for his admirable docility.

We used to fancy that Mohammed had a low idea of the fair sex,

but, with our Emir to instruct us, we now know better. The messenger of God has said, "The greatest of blessings is an intelligent woman or a prolific mare." But the Prophet was so *hippocratic* that we suspect he valued *houris* in proportion to their being lovers of horses.

It is in the early education of the colt, and in soon accustoming him to fatigue, that the Arabs specially differ from us. "Every horse inured to fatigue brings good fortune." At the age of eighteen to twenty months the colt is mounted by a child, who takes him to water, goes in search of grass, or leads him to pasture. The boy and the colt are thus simultaneously educated; the one to be a horseman, the other to fear nothing, and obey the will of his owner.

The colt is also now accustomed to be shackled with clogs, of which mode of shackling General Daumas highly approves:—

"With it one never hears of a horse breaking loose—a misadventure that causes such confusion in a bivouac, drives horsemen to despair, and is the source of a thousand accidents. The Arabs are loud in their abuse of our mode of tying up horses with a longe. They affirm that, in addition to the accidents it may occasion, it has the great inconvenience of not allowing the animal to lie down; whereas with clogs a horse protrudes his head and neck, and when he wants to sleep, places himself exactly in the position of a greyhound basking in the sun. Besides, a great many stable vices disappear when they are used: the animal can neither entangle itself in the halter, nor slip it, nor get into the manger, nor lie down beneath it, nor scratch the earth with its foot, nor rub against the manger, nor contract any bad habits of the kind: an indisputable advantage so far."

At the age of from twenty-four to twenty-seven months the colt is cautiously saddled and bridled—the bit being for the first few days covered with undressed wool. Wealthy owners, before allowing their colts to be mounted by a grown man, sometimes have them led up and down gently for a fortnight with a pack-saddle on their backs, supporting two baskets filled with sand.

"Suppose the colt now to have completed two years and a half, his vertebral column has acquired strength—the clogs, the saddle, and the bridle are familiar to him. A cavalier mounts on his back. The animal is certainly very young, but he will be ridden only at a walking pace, and his bit will be a very easy one. The main point is to accustom him to obedience. The owner—without spurs, and holding only a light cane, which he uses as little as possible—rides him to the market, or to visit his friends, his flocks and pastures, and attends to his affairs, without exacting anything more than submission and docility. This he ordinarily obtains by never speaking to him except in a low voice, without passion, and carefully avoiding anything likely to elicit opposition, that must result in a contest from which he might come forth conqueror but at the expense of his horse. Particular importance is attached to keeping the young animal still and quiet for a few minutes before letting him start."

When the colt is about thirty months old he is taught not to break loose from his rider when dismounting, and not even to stir from the spot where the bridle has been passed over his head and allowed to drag on the ground. This lesson, so important to

Arabs, and which all horses should learn (as *our steed* has learned), is taught thus:—A slave stands beside the colt and puts his foot on the bridle whenever the animal is about to go off, and thus gives a disagreeable shock to the bars of his mouth. After a few days of this exercise he will stand stock-still at the place where he has been left, and to which he possibly fancies that he has been fastened. What would a farmer think if he saw a man go into the midst of a horse market, pass the bridle over his horse's neck, let it fall to the ground, put a stone upon it, and then proceed for a couple of hours to transact his business? And yet this sight, the result of the simple process we have described, may be constantly seen among the Arabs. Kneeling is the perfection of the Arab horse's education. The colt is trained to it by tickling him on the coronet, pinching him on the legs, and forcing him to bend the knee. After such a training—for which, however, all horses are not fit—his rider has only to clear his feet of the stirrups, stretch his legs forward, turn out the points of his toes, touch with his long spurs the animal's forearm, and then, as his piece is fired at marriage-feasts and other rejoicings, his horse will kneel down amid the applause of the young maidens, piercing the air with joyful acclamations.

Apròpos to kneeling to young maidens, a very learned man once confidentially asked us if, when making love, he must kneel to his fair one? As we said No, it cannot be expected that we should advise that our horses shall be trained to treat the ladies as if they were queens. But in the hunting-field, the habit of standing still when desired would be a truly useful habit of the horse, for which farmers, country doctors, and clergymen would be thankful, when moving about the fields, dismounting at ill-made gates opening with difficulty, and requiring a two-handed tug, or tarrying at cottage doors where nobody can be got to hold the horse, the goodman being absent, the wife sick, and the children all literally weans (*wee anes*).

The power of intelligence and gentleness in developing the usefulness of the horse to man is strikingly seen when in the bivouac. The Arab horseman sleeps with his head resting on his horse's shoulder; an arrangement furnishing an easy pillow, and rendering the theft of the horse a difficult achievement.

But it must not be supposed that the Arabs are all gentleness. A horse needing chastisement gets it by means of tremendous spurs, with which the rider draws long bloody wheals along the animal's belly and flanks, which inspire him with such terror that he becomes as tame as a lamb, and will track out his master like a dog.

They have a proverb, "The horseman makes the horse, as the husband makes the wife;" and therefore every Arab trains his own horse. Here, we opine, is a hint worth something to every man wishing to be on comfortable terms with his horse—or his wife.

We certainly resent any interference with our conjugal authority; and husbands and wives, upon the whole, jog on pretty well in the

matrimonial yoke. But our horses are treated shockingly ill; their education is intrusted to an ignorant groom or a brutal breaker-in, with hardly a single right idea as to the philosophy of equestrian training—which, by the way, is begun and *finished* by the Arabs at a much earlier age than with us. “The horse,” they say, “is a labourer; let him, then, be accustomed to it in good time.” They universally fatigue him without mercy when two and three years old, but spare him from three to four years of age. They maintain that sustained work at an early age strengthens the chest, muscles, and joints of the colt, at the same time imparting a docility that will never leave him. After these rude trials are over, his constitution should be developed by rest and abundant diet, because now he will show whether he be worth keeping.

Such, also, is the testimony of M. Pétinaud, who was commissioned by the French Government to travel through Upper Asia to procure horses of pure Oriental blood. And as the treatment of the horse by the Arabs of Asia and Africa is thus shown to be identical, and as these men are confessedly the best horsemen in the world, and thoroughly acquainted with the modes of training the animal to be serviceable, it is not unlikely that British breeders will ere long be brought to see the advantage of putting the colt to salutary work from its earliest age.

Feeding is very carefully attended to, each horse receiving a ration proportioned to age, temperament, and work to be gone through. Being convinced that milk maintains health and strengthens fibre without increasing the fat, which they dislike, the Arabs give their horses ewe's or camel's milk as abundantly as they can. The great article of horse food is barley eaten out of a nose-bag, and barley-straw. At night, during winter, the horses get quantities of alfa grass (*Lygeum Spartium*), which furnishes the material of so much of the paper manufactured in this country. Our learned Emir informs us that the Saharene gives his horse camel's milk to drink, “which has the property of imparting speed, so that a man, if he takes nothing else for a sufficient time, will attain to such a degree of swiftness that he may vie with the camels themselves!” As we have no such milk we cannot try the experiment on man or beast; but there is a point in which we may imitate the usage of the Arabs, and not of them only, but of most Eastern nations—we mean the giving of barley to horses. “When thou hast purchased a horse, study him carefully, and give him barley more and more every day, until thou hast ascertained the quantity demanded by his appetite. A good horseman ought to know the measure of barley suited to his horse as exactly as the measure of powder suited to his gun. The Prophet has said—‘Every grain of barley given to your horses shall secure you an indulgence in the other world.’”

Give barley to your horses; deprive yourselves to give them still more, for Sidi-Hammed-ben-Youssouf has remarked, “Had I not

seen the mare produce the foal I should have said it was the barley." He has also said, "Superior to spurs there is nothing but barley."

Here are some maxims of the Emir showing sense and humanity:—

"Never water your horse after having given him barley; it would be the death of the animal.

"Leave not thy horse near others that are eating barley without he has some likewise, for otherwise he will fall ill.

"If, at the bivouac, your horse is so placed that he cannot move out of the wind that is blowing violently into his nostrils, do not hesitate to leave the nose-bag suspended from his nose; you will preserve him from serious mischief."

The nose-bag in such a case acts the part of "Jeffrey's patent respirator," and hinders inflammation of the mucous membrane lining the air-passages leading to the lungs. In the human subject this would be termed bronchitis, which we have just seen produced in a boy when overheated sitting down exposed to the wind and having on no nose-bag—*i. e.*, "comforter" or "respirator."

In the same philosophic dread of a strong wind right in one's teeth, the Emir adds,—"Contrive, if possible, to save your horse from facing it; you will spare him various diseases." "When you dismount, think of your horse before thinking of yourself: it is he who has carried you, and is to carry you again." That deserves the thanks of the Society against cruelty to animals. Moreover, the Emir is qualified to be president of an abstinence society, for has he not written?—"The cavalier of truth should eat little, and, above all, drink little: if he cannot endure thirst he will never make a warrior—he is a mere frog of the marshes."

And all who remember that "in the midst of life we are in death" will approve of this religious maxim of the Arab cavalier—"When thou mountest a horse first pronounce these words, 'In the name of Allah;' the grave of the horseman is always open."

Moreover, those seeking to reform the turf may learn something from the Mussulman law, which not only forbids racing for a wager, but all betting by persons not personally concerned in the race. In fact, if we will only have the modesty to confess that from an Arab we may learn something worth the knowing, we must acknowledge that both the horse and his rider will be benefited by the diffusion among us of the views imported by General Daumas from the Great Sahara.

We have not touched upon the second part of his work, in which he gives a vivid picture of the manners of the desert, and we are far from having made our readers acquainted with all that is noteworthy in relation to horses—the special subject of our article. We must desist, however, and now conclude with commending the work to the perusal of all interested in anthropology—

"The proper study of mankind is man."

Who can fail to wish to know more of the singular being who, in the conclusion of a 'Chant to his War-horse,' draws this picture of himself:—

"I am an Arab. I know to command and to combat;
My name protects the feeble and the afflicted;
My flocks are the reserve of the poor,
And the stranger in my tent is named the Welcome One.
The Almighty has loaded me with his gifts,
But time turns upon itself, and turns back,
And if I must drink one day of the two cups of life,
I will show that adversity cannot humiliate my soul.
My virtue shall be resignation,
My fortune the contempt of riches,
My happiness the hope of another life;
And if poverty were to grasp me by the throat,
I would not the less glorify Allah."

SELF-ACTING SYPHON.

By JAMES RAIT, Land-Steward at Castle-Forbes.

USEFUL discoveries have taken their rise commonly, if not uniformly, from very simple circumstances watched and noted by reflective minds. Before the seventeenth century many an owner of an orchard had seen his apples fall by the hundred, and probably the uppermost or only thought that crossed his mind in regard to them was, when the fruit happened to be injured, the loss that would befall his own pocket. But the fall of an apple before the eye of a Newton afforded the key to a mystery. A hundred and fifty years ago there was to be seen, on the banks of the Doveran, in Banffshire, a person in humble circumstances, the roof of whose cottage threatened to give way. Quite naturally he introduced a temporary support and lever to raise the roof till he should get something of a more permanent character introduced. On this, as on many a previous occasion, he used this mechanical appliance without giving the matter a thought beyond the requirements of the hour. But by his side stood his son, a boy seven or eight years of age, who beheld the operation with astonishment mingled with terror, as he fancied at first that his father had lifted the roof by sheer strength of arm. Thinking a little over the matter, he recollected that his father had applied his strength to the end of the lever farthest from the prop, and finding on inquiry that this was the means whereby the seeming wonder was effected, he began making levers, and applying weights to them in various ways, and found the power gained by the lever (or, as he then called it, "bar," for want of knowing the proper term) was just in proportion to the

lengths of the lever on either side of the prop. The mind of the boy, set in action by the above simple incident, eagerly pursued the path of knowledge, till it issued in his becoming Ferguson, the famed astronomer; and the other day his "relics," purchased at considerable expense, were deposited in the museum of his native county town.

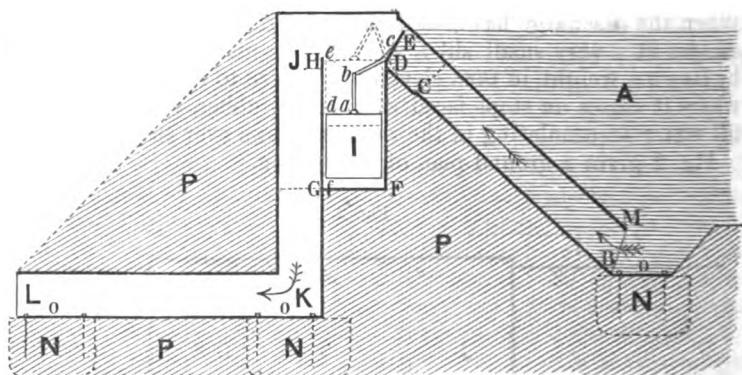
Looking down on a colony of black ants, the spectator sees here one with a grain of sand, there another with a fir-leaf, tugging and tumbling, sometimes the burden and sometimes the bearer uppermost—now the one and now the other foremost—but come what may, this grain of sand and that leaf to the ever-accumulating heap must go. Either object looks small for all the trouble requisite to transport it, yet the aggregate results of these apparently insignificant labours strike every beholder with wonder. In like manner the results of human ingenuity and perseverance have gone on accumulating, till we of the present day, who reap the benefit of the toils of those who have passed away, are often oblivious of the difficulties which had to be overcome ere the attainment of much that now forms our daily and indispensable comforts. Much as has been done in the past, much remains to be done in the future; and, we doubt not, discoveries as brilliant as any that have ever been made yet await the attentive student of nature, and venture to predict that nine-tenths of the discoveries looming in the future will be made by the plodder.

If it is asked whose duty it is to render assistance in the attainment of increased knowledge to the human mind, we answer, It is the duty of all. No two leaves in the forest, no two blades of grass in the field, are exactly alike, so no two individuals have ever been placed in exactly similar circumstances, and each has thus some peculiarly favourable opportunity of observing nature in a light different from his fellows, and he who neglects to improve his opportunities betrays the trust committed to him by his Creator. As a humble contribution towards the sum of human knowledge, I beg to offer in this paper a few remarks on a self-acting syphon for sanitary purposes. So far as I have been able to ascertain, after some inquiry among architects, iron-founders, and others, nothing of the same kind has been introduced to the notice of the public hitherto.

Near what happens to be the residence of the writer, there is a mill used for thrashing grain, bruising oats, &c. In summer the quantity of water in the mill-pond is often barely sufficient to meet the various requirements; but farther up the hill there is a pleasure-pond of considerable extent, fed by a very limited supply, and as the temptation is great, he is sometimes induced to draw off a little from the latter to make up for the shortcomings of the former. In order to prevent anything of unsightliness, as also thoughtless little folks from interfering with it, a box or tube (corresponding to the

ascending limb of the syphon B D E M, fig. 1) was sunk into the inner face of the embankment, the upper end rising in the turf a little above the level of the water, the lower end placed several feet below the surface. On lifting a bit of turf at the upper end there appeared a sort of lid, on removing which two small boards, each 16 by 3 inches, made their appearance, and one or both of these could be drawn up so as to allow the required quantity of water to run off. On leaving this point, the water descended through a continuation of the wooden tube (corresponding to the descending limb of the syphon J K L, fig. 1). When one of the boards was drawn up, the flow ceased when the water in the pond had sank three inches, and the other being subsequently drawn up, it quietly sank the other three. On the other hand, when the pond was full, and both boards drawn at once, and the lid and turf immediately replaced, the result was altogether different. The tube then acted as a syphon, and the water, before being observed, sank far below what was intended. Of course, a small hole to admit air, bored in the tube near the surface of the water, prevented a repetition of this.

Fig. 1.



A, reservoir 6 feet deep, fed by a pipe $\frac{1}{4}$ inch diameter.

B C D, ascending limb of syphon, from B to C 18×11 inches, and from C to G (descending) 20×12 inches.

D E, valve, $20 \times 11\frac{1}{2}$ inches, hinged at D.

D F G H, float-box, $36 \times 20 \times 18$ inches.

I, zinc float, $19\frac{1}{2} \times 18 \times 17\frac{1}{2}$ inches.

a b c, jointed lever.

J K L, descending limb of syphon, from G to L 18×11 inches.

N N N, stones, $26 \times 26 \times 12$ inches.

O O O, cast-iron plate.

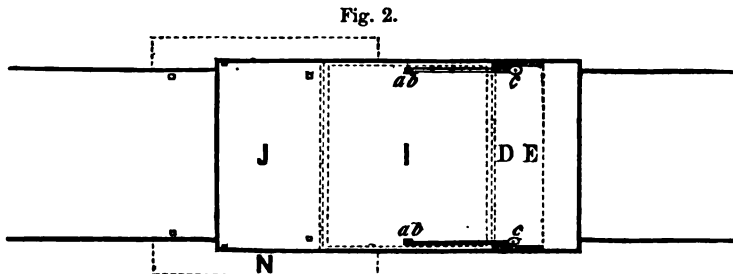
P P P, clay embankment.

After this incident occurred, a gentleman who had a very limited supply of water for his mansion-house, happened to remark with regret the difficulty he had in getting his sewers regularly and

thoroughly flushed. The trick the writer had got with the pond instantly recurred to him, and on the way home he worked out in his own mind the simple contrivance now before the reader. As it is not at all uncommon for a model to appear very satisfactory in the eyes of the designer, and for his full-sized machine or implement to turn out anything but satisfactory, it was resolved that an experiment should be made on a scale quite as extensive as anything likely to be required in practice for the purpose in view, and thus the syphon actually made discharged a volume of water sufficient to drive any two thrashing-mills in the parish. I shall endeavour to give a brief explanation of the contrivance.

The water flowing into the reservoir A enters the syphon at B, rises till it reaches the top of the valve E. Here, running over, it falls into the float-box D F G H, where, accumulating, it elevates the float I, and, by means of the lever *a b c*, it depresses the valve from the position D E to the position D C, the float rising from *d* to *e*. While this is taking place the water dashes across from the valve D E, and, descending by the limb J K L, expels the air from the syphon. The flow continues till the supply in the reservoir is exhausted, when, air entering at M, it ceases; the column of water in the ascending limb falls back at this juncture into the reservoir. When the discharge has ceased, the water remaining in the float-box escapes at a very small slit *f*, allowing the float to sink. The float, by its own weight, in turn elevates the valve to its original position, where it closes on stops faced with India-rubber, and there it waits till water accumulating in the reservoir flows over the top again.

Fig. 2 gives a ground plan of the syphon.



D E, the valve; I, the float; *a b c*, the levers; J, the descending limb; N, stone base.

What may be termed the working space from C to G, fig. 1, and more readily seen, fig. 2, requires to be wider than the other portions of the syphon, in order to afford room for the play of the working parts, and to prevent them from interfering with the progress of the stream. Fig. 2 is cut large in comparison with fig. 1, for the sake of distinctness.

The sole merit of the contrivance now under consideration consists in this, that the amount of the supply of water flowing into the reservoir does not in any appreciable degree affect the amount of the discharge while the syphon is in action. The volume discharged is limited only by the area of the tube available for discharge, and the height of the surface of the water in the reservoir above that part of the discharging limb marked K L. The volume of water discharged may, with equal facility, be ten times or ten hundred times the area of that flowing into the reservoir. The flow into the reservoir may be steady or it may be intermittent—it may be clean water spilt from time to time at a sink, or it may be the waste water from a small fountain; the only result will be, that the greater the difference between the supply and the volume of the discharge, the longer will be the interval between any two actions of the syphon. If the supply is uniform the discharge will be made with the regularity of clock-work, and in this case provision may be made to turn the result of its operations to account at the ascertained point of time. The extent of the slit or opening at *f* must be proportionate to the supply of water flowing into the reservoir, as, if too large, the water would flow out as fast as it fell into the float-box, and thus the float would not act. The valve also must be water-tight everywhere except at the top, otherwise, water getting out prematurely, the float would mount up and depress the valve too early, and then the quantity of water that could flow over would be insufficient to expel the air from the descending limb, consequently the syphon could not act. It is desirable to have an air-tight lid above the working parts, so that if anything happens to get out of order it may easily be rectified. It is almost needless to remark that the whole work must be so constructed as to admit air at M and L only.

Although the syphon, constructed for the purpose of carrying out the experiment presently under notice, discharged a column of water 198 square inches, and emptied in a few minutes, what happened to be the readiest reservoir, a thrashing-mill dam, there are few cases in which it would be required on so large a scale for sanitary purposes of a private nature. The reservoir may be placed almost anywhere—may be above or below ground, may be constructed of brick or clay, or, for that matter, of the iron tank of an old whaling vessel.

That there is great need for something of the kind in instances not a few is abundantly evident, and that it would pay is as evident, when it was publicly stated the other day in Edinburgh that the introduction of sewerage, in a case then adverted to, had reduced the rate of mortality a very large percentage. No longer ago than last week, the writer happened to converse with a gentleman who had recently entered on a lease of a mansion-house, and who remarked that the drains and sewers connected with it had not been flushed for many years; in fact, so far as an old servant about the

place knew, they had never been so. Little wonder although fever and like infectious diseases are prevalent under such a state of matters. During last summer cases of fever were uncommonly numerous and fatal in that part of Aberdeen adjacent to the harbour, and there the sewers were reported to be in a very bad state owing to the rise of tidal water in them. Could not the plan now offered be made available to obviate this evil, and the tidal water be made to do the principal part of the work by nearly filling cisterns, which, before low water, could be completely filled from above, and thus made to discharge their contents in full volume at ebb-tide ?

THE FARMERS' NOTE-BOOK.—No. LXXXIII.

*Poultry Exhibitions in Paris.**—We are happy to understand that our translations from foreign journals have met with approval; we are therefore encouraged to carry out our design to make our readers acquainted with the doings of those societies which, especially in France, are so intelligent and active.

Having translated an article on the turkey, we have been naturally led to think of poultry in foreign parts, and now proceed to give, slightly abbreviated, the report of Dr Rufz de Lavison on a Parisian poultry show. It contains facts and opinions deserving consideration. We direct special attention to the importance which the Acclimatisation Society attaches to purity of breed, and to the discussion upon fat. The introduction of so many new species of fowls has been followed by an intermixture of breeds, which threatens confusion of all characteristics of species; and there is as much need to guard against the over-fattening of fowls, as, until lately, there was to protest against the useless obesity of the animals which carried off the prizes at our cattle shows.

As to the *on dit* of our French friends, that our use of fat meats is injurious to the permanency of the fine complexions and rounded shapes of British ladies, we can only say that with us it finds no credit.

“ Jack Sprat could eat no fat,
His wife could eat no lean ;”

and we are confident that Mrs Sprat's preference for fat arose from conviction of its conservative effect upon her charms. Moreover, we knew a very comely lady who literally died of fat; her beautiful complexion, however, remained long after she was unable to

* ‘ Report to the Imperial Society of Acclimatisation on the Poultry Show in the Acclimatisation Garden, Bois de Boulogne.’ By M. le Docteur Rufz de Lavison.

walk. Finally, our familiar expression "fat, fair, and forty," demonstrates that the beautiful rotundity of our fair ones is not so fugacious as Frenchmen fancy. But let us begin to translate.

This exhibition has confirmed the demonstration already furnished by most poultry shows—namely, that the native breeds La Flèche, Crévecœur, and Houdan are undoubtedly the most beautiful and the best fowls, and those the propagation of which deserves to be encouraged. The beautiful Crévecœur breed was the most numerous and the best represented. It numbered 55 lots. The magnificent specimens for which M. Simier gained the prize of 100 francs, offered by M. Furne, were really model types of the race, and in size and weight rivalled the finest specimens of the Asiatic breeds. I can say the like of his La Flèche and Mans fowls—they were worthy of their European reputation.

M. Simier exhibited two other varieties—the one called the Mans hen, which only differs from the La Flèche in the form of its comb—and the other called *short-claws*, stumpy, vigorous, rustic, well-fleshed, no beauties to look at, living on nothing, and laying all the year. This is the poor man's hen in La Sarthe.

The only objection that can be made to the beautiful La Flèche and Crévecœur breeds is, that they require fattening and particular attention, and that in general they only appear at the tables of the rich, seeing that in the Parisian market some of them are as high as 25 francs. To this it may be replied that, in the districts where they are reared, the breeding of them is one of the most important of that secondary industry which benefits local agriculture, and enables small holders to live well.

The jury this year also admitted, as a supplement to the exhibition, the best common breeds—those most in repute for selectness, for laying, or for some other advantage. Such are the Brie and the Beauce hens, a variety called Janzé, the better known breeds of Caussade, Barbézieux, and that of Gascogne, formerly so prized, and which owes its reappearance to M. Granié of Toulouse, who, in our bulletins, has published an excellent memoir on these fowls, and devotes his time and fortune in preserving to the geese of Toulouse, and in giving to the capons of Gascogne (of which he exhibited two magnificent specimens), the fame acquired to them through the gay science of the troubadours.

The beautiful white fowl of Brie, named from *l'île d'Amour*, like white fowls in general, is chiefly valued on account of its feathers, employed in feather industry, and fitted for the reception of different dyes. The Caussade and Barbézieux fowls, besides the goodness of their flesh, are sought after by epicures for their large comb. History relates that Heliogabalus required that the combs should be torn from living cocks. This barbarous refinement would shock our morals; but the trade in cock's combs is at Paris still so considerable as to lead to fraud, which is marked in the too exten-

sive list of commercial frauds. It consists in trimming ox palate into the shape of a cock's comb.

Let us, in the last place, not forget to add to the number of the common farmyard hen's merits, that she is the most rustic, the most easily fed, and proverbially the best of layers. The specimens exhibited prove that she may attain a respectable size.

The La Br sse breed, which all over the south-east of France, and particularly at Lyons and Geneva, has no rival—which, as chickens, even figures largely in the Parisian market during winter—the yield from which, according to a La Br sse rearer, M. Chanel, amounts to 600,000 francs a-year for the department de l'Ain, and is not only devoted to the expenses of the household, but is also taken into account for payment of the rent—this breed was only represented by a single lot of mediocre appearance and contestable characteristics.

Finally, the valuable Houdan breed, which daily supplies the Paris market—and which, by a kind of medium conjunction of all the qualities of native fowls, is now as much in request for its eggs as for its flesh—although represented by sixteen lots, did not obtain the prize instituted by a celebrated amateur and a very competent judge, M. Jacque. The hens were fine, but the cocks were faulty through lack of some characteristic particular, and often raised the suspicion that they were mixed with the Cr vec ur, or some common or Asiatic breed.

Now, it is very important to watch over the maintenance of these pathognomic characteristics of breeds, and not allow ourselves to be seduced by beautiful plumage or extraordinary corpulence, which often are fugitive qualities, individual accidents, which are not reproduced, and are rather the result of feeding than of breed. In the numerous crossings which are practised nowadays, and which will end in a general degeneracy, the characteristic signs are what should be marked in order to find out and preserve the purity of breeds.

Another discussion arose in the jury touching fat fowls. The fattening of fowls is a very ancient art. In Roman history we find sumptuary decrees published eleven years before the third Punic war, allowing the use at table of simple fowls, and forbidding those which were fattened; but luxury knew how to elude these sumptuary laws, and procure fowls as big as geese. The Romans adopted the same methods as ourselves for the procuring of fat fowls and capons. They fed them with the farina of various grains, and with grey pease. These aliments were forcibly introduced into their gizzard; they were soaked in milk, precisely as is now done with certain fowls of Houdan and La Fl che destined for the sumptuous tables of Paris.

We now fatten all fowls intended to be eaten; it is certain that fattening renders the flesh whiter, more tender, and more savoury.

But we are not speaking of a moderate and rightly-conditioned fattening; it is of fattening carried to excess, as practised on certain fowls, and which produces accumulations of fat in certain parts of the body, gives greater size and appearance, even to making them weigh from 15 to 17 lb., and to sell at an increase of price because of their fatness. Fattening is then a kind of lymphatic disease communicated to the animals by all arrangements fitted to diminish the activity of functions, and cause the lymphatic system to predominate over the sanguinary. It seems that first of all we should discuss the physiological question as to how far fat should be considered alimentary substance.

I do not know whether, on this point, there be any experiments which have led to practical conclusions; it is certain that the English, who largely use these fat meats, are not much the worse of them, although it is said that the fine complexion and roundness of form resulting from them do not long hold out against time, and disappear sooner than in countries whose inhabitants live on food more simple and less fluid. This is certain: the fowl which is not shut up in darkness and immobility in order to be fattened, but which enjoys the liberty of the fields, has a flavour approaching that of game; whereas fattened meats are very insipid, especially when served up hot. The English are therefore accustomed to eat them cold, when the fat is solid and jellied, and to heighten their flavour by eating with them other meats salted and smoked, such as ham. It is an axiom in gastronomy that fattened fowls should be eaten cold.

As this discussion of the jury took place at table during lunch, with illustrative examples, it was perhaps more opportune than in this learned assemblage.

Another, not less interesting, referred to rearers and salesmen. While granting that all specimens exhibited should be judged according to intrinsic merit, and not from knowing where they came from, or any other consideration, the majority of the jury were evidently disposed to show a certain favour to rearers.

It was admitted that, in the long-run, the salesmen were as useful to the rearers as the rearers to the salesmen; that in seeking for fine specimens the salesmen raised their value, and stimulated their propagation quite as much as any other stimulus. But it was acknowledged that the salesman, only thinking of gain, was sufficiently rewarded, and to his satisfaction, by the high prices obtained in return for his agency; that he could not have that feeling of attachment and of pride which is called forth in the rearer by the approbation given to the animal reared by himself—a feeling which it is of importance to encourage; for, at least quite as much as gain, it keeps up that taste for rearing which demands such sustained perseverance, such a spirit of observation, and often such sacrifices. These observations borrowed, so to speak, new strength from

seeing what was exhibited by an English lady, Mrs Fergusson Blair, *née* Douglas. This lady brought from Scotland more than eighty specimens, consisting of Dorking cocks and hens, Cochinchinese, Brahmapootras, turkeys, and ducks. The whole of this collection was beyond common. All the specimens were most choice. Mrs Fergusson Blair is one of those distinguished English ladies who, following the example of Queen Victoria, do not disdain to occupy themselves in the courtyard, and to seek noble employment in improving these valuable breeds. Though only an amateur, she is said to be well known at the poultry shows in England.* The jury, delighted with the sight of these beautiful productions, had no hesitation in granting to her, as well as to a French rearer, M. Simier, two gold medals; one for her collection as a whole, principally for her Dorkings and turkeys—the other for a very pretty breed of little game-cocks and hens, called duck-wings. This is their first appearance in France. They are not bigger than the partridge, which, especially the hens, they greatly resemble in gait and plumage, and, it is said, they may be reared in parks like pheasants, and enrich our sport with a new game. In courage and pride they are veritable miniatures of the beautiful English game-cock.

Mrs Fergusson Blair's Dorkings were the finest that could be seen of this fine English breed. This lady asked 1500 francs (£59, 10s. 6d.) for a cock and two hens. In England that is not an extraordinary price. Our neighbours are wisely of opinion that good rearers are never too highly paid, and therefore buy readily.

The Dorkings are the English breed *par excellence*. They are so named from a village in the county of Surrey. They are the true poultry for great tables. The fat, which they readily take on, does not collect in certain parts of the body, but is diffused through the whole flesh, and renders it white and savoury; their bones are small. Some breeders object to the Dorkings that they are difficult to rear, and need a great deal of care and of food. It is, nevertheless, desirable that they should be multiplied in France, both as a pure breed and as an element in crossing. It is said that in La Brèche they have been profitably used with this object.

The beautiful Asiatic breeds, Cochinchinese and Brahmapootras, were represented by the finest specimens of their numerous varieties. There is no concealing that these breeds, after being greatly in vogue, are now gravely criticised. They are reproached for having introduced a certain degeneracy into the flesh of the common fowls sold in our markets; for, almost everywhere, tempted by its extraordinary corpulence, they have been used in crossing. This proves at once how readily this fowl is reared, for, wherever introduced, it has

* This lady will smile at the words in the original,—“ Elle est très connue sur le turf de la volaille dans les concours anglais.”

been easily acclimatised. Introduced into France in 1846 by Admiral Cécile, it may be asserted that it now exists in all its departments, and probably all over Europe. If it be undeniable that, by injudicious crossings in many localities, it has made the flesh of our common fowls higher coloured, harder, and less appetising, it must be acknowledged that it has added to the size of the eggs, especially in their true nutritive part, the yellow or *vitellus*, which is the germ of the chick; and that it has made our farmyard fowls, with which it has been crossed, less rambling, less addicted to scratching, and, above all, better layers. Réaumur, in his day, complained that in a hundred hens he could only get ten sitters, which induced him to have recourse to artificial incubation; nowadays, thanks to the passion for Asiatic fowls as hatchers, artificial hatchers are ingenious machines, but useless and merely curious. M. Jacque, a great advocate for purity of breed, said to us that Cochinchinese and Brahmas are excellent transition animals to obtain sub-races with Crèvecoeurs, Dorkings, and, in general, with all those delicate races which turn lymphatic. I know no better cross: the Asiatic breeds appear to infuse into cold flesh some of the heat of their native clime.

We had some specimens of La Flèches crossed with Cochinchinese exhibited by M. Simier, and some Dorkings crossed with Brahmas, exhibited by M. Rousset under the name of the Alfort breed. Now, it is the *toquade*—allow me to use a word not yet academic, but which is used to express what *mania* would be too strong for—it is the *toquade* (or hobby) of rearers to create breeds, in order to obtain a new combination of animal matter. This presumption in imitating God is doubtless not small, but is at bottom fortunate, very innocent, but not always to be easily justified; for these pretended races so created are not long in altering, and, through the force of atavism, very soon come back to one or other of their primitive elements. This is now the general doctrine upon this point; but M. Rousset affirms that his Alfort breed has been renewed for eleven years with its characteristic signs fixed throughout the generations. "Why," asks the newspaper 'Le Siècle,' "should the Alfort breed not form a new breed? Every year there are hatched at M. Rousset's three or four hundred chickens perfectly alike; can this be called a result of crossing? M. Rousset one day found a superb hen, allied possibly to the Brahma or the Dorking, but neither Dorking nor Brahma. He made it the origin of his breed—that is, by careful selection of breeders he succeeded in regularly producing the animals which we know. How have the breeds of our domestic animals been created? I do not know, but the celebrated breed of the Durham ox was not created in a different way. In the county of Durham Collings met a cow, herded by an old woman, grazing on the sward of a dirty road, and from this famous cow sprang the Durham."

M. Rousset is evidently not satisfied with the simple bronze medal which the jury gave to his Alfort breed, to which he attributes all the qualities of its double parentage; and in order to convince us, he has left, in the Acclimatisation Garden, his fine lot of the Alfort breed which gained the prize, in order that we may there publicly and authentically follow out the permanence of its qualities in its progeny, and so dispel existing prejudices against hybridisation.

Assuredly the question of crossing among all the animal races is not yet settled. Nowadays, when prosecuted more methodically and precisely, we may hope that we shall not be long in arriving at more definite conclusions. In the *Gallinaceæ* it is most interesting to prosecute this study thoroughly. We are obliged to those who, like M. Rousset, devote themselves to it. In natural history, however settled an opinion may be, we must always leave an open door for an opposite opinion when it presents itself with new facts.

This exhibition will no doubt, as you expect, do good in spreading improvement through that kind of stock which, in great administrative exhibitions, local exhibitions, and agricultural committees, has only ranked secondary and as an adjunct. But the importance of exhibitions of this kind must not be judged by the bulk of the animals composing it, and by comparing them with larger animals. We must reflect on the importance of the fowl to the domestic economy and general commerce of France.

Irish Agricultural Statistics for 1864.—The returns by the Irish Registrar-General are made up annually, from information collected by upwards of 4000 enumerators, selected from the constabulary force in that country, and there is every reason to believe are sufficiently trustworthy to enable people to form a tolerably correct idea of the actual state of matters.

The returns for 1864 show that the total extent under cereal crops was 2,287,461 acres, being a decrease, as compared with 1863, of 122,437 acres. Flax cultivation, however, had superseded corn growing to some extent, for we observe that 301,860 acres were occupied by that crop, being 87,761 acres more than in the previous year. It was in oats that the only decrease in cereals occurred; wheat, especially, being more extensively grown than in 1863.

The total extent under green crops, including potatoes, was 1,475,535 acres, of which potatoes alone occupied 1,039,282 acres, or 15,868 acres more than in 1863. Turnips, however, occupied 14,153 fewer acres than in the previous year; mangold-wurzel also declined 2328 acres, and cabbages 2369 acres. Of "meadow and clover" there were 1,608,124 acres in the returns for 1864, being an increase of 47,486 acres over the previous year; arising, no doubt, in a great measure, from the scarcity and high price of cattle

last spring, which prevented many pasture fields from being stocked, and the grass of these was mown in consequence, and made into hay. There was also an increase of above 58,000 acres in the extent of "bog and waste *unoccupied*," which arose partly from the same cause, and partly from the emigration of small farmers.

The live stock returns show that there was a decrease of 9707 "agricultural" horses; of 7463 in those one year old and under two years, and of 3178 under one year; proving the decrease in tillage and in breeding which has been going on in Ireland of late years. In the class of horses employed in "traffic and manufactures" there was an increase of 613; and in those used for "amusement or recreation" of 1118.

There were altogether 1,346,217 milch cows in Ireland in 1864, or 50,707 fewer than in 1863. Two-year-old cattle and upwards also declined in numbers, being 4906 head under the returns for the previous year. Those "one year old and under two years" were 50,215 more in number, and those "under one year" also increased to the extent of 118,476 head over 1863. In sheep there was a general increase of 54,864 head, although there were 4182 fewer "tups and wethers" than in 1863. Pigs were 11,209 short of the previous year's returns, the decline being altogether confined to those one year old and upwards.

The total number of live stock in Ireland in 1864, was as follows:—

Horses,	.	.	.	.	561,361
Cattle,	.	.	.	.	3,257,309
Sheep,	.	.	.	.	3,363,068
Pigs,	.	.	.	.	1,056,249

The emigration returns only include the first seven months of 1864, and it appears that during that period 84,586 persons left Ireland "who stated it was their intention not to return," being an increase of 4080 on the number for the corresponding months in the previous year. The entire number of emigrants from the 1st of May 1851 to the 31st of July last, has amounted to 1,499,642 persons.

AGRICULTURAL SUMMARY FOR THE QUARTER.

THE mild open weather which characterised December was succeeded by a heavy fall of snow, which, on the morning of the New Year, covered the ground to a depth of six or seven inches, while in places the snow was drifted into wreaths four or five feet deep, even on the low grounds. On the following day there was thaw, with frost at night; but this was not lasting, and for about a fortnight we had very changeable weather, frost, rain, and wind alternating with each other. The third week of January was a severe one, the frost entirely putting a stop to the plough, and covering the ponds with ice, greatly to the delight of those with a *penchant* for curling, and who had almost given up the hope of being able to join in the "roaring game" this year. In the last week of January we had one of the severest snow-storms that has been experienced for many years. Railway trains were snowed up on many lines, some of them for nearly two days; and the difficulties which passengers had to encounter in obtaining shelter and refreshment were almost insurmountable. The traffic on roads, in many cases, was completely stopped, the snow having been drifted into masses seven, eight, and even ten feet deep. Wherever there was a sheltering wall or hedge, the snow was often to be found packed up to the full height of such fences; and as the wind blew for one or two days after the fall, any cutting that was attempted to be made was soon filled up again. As an instance of the severity of the storm, it may be mentioned that there were at one time no fewer than seven trains snowed up in the vicinity of Tynehead station. So great was the drift here, that some of the engines are said to have been completely buried in the snow, their funnels alone being visible. In the first week of February there was a thaw, which prevented the great national curling match between the north and south of Scotland from coming off; but there was soon a return to frost again, and at the time we write (20th) it has continued hard, though there appears to be now symptoms of change. On Wednesday (15th) the barometer indicated a change, but as yet we have only had a pretty heavy fall of snow on Thursday, which again covered the ground to the depth of two or three inches, and we had a still heavier fall on Saturday afternoon and night. Ploughing may be said to have been almost entirely stopped since the first great snowstorm; and even if it came thaw now, it will be some time before the frost is sufficiently out of the ground to admit of the ploughs being put into operation. Farmers were not sorry to see the frost and snow, as all the work of the farm, save the carting out of manure, was well forward, and this the hard weather has enabled them to accomplish with the least possible labour to man and horse. The snow formed a

fine warm covering to the young wheat, which everywhere before the storm looked particularly healthy and vigorous; and indeed almost too much so, for there was a danger that, without the timely check which the frost imposed, it would become "winter proud." Turnips, where exposed, were also protected from destruction by this cosy mantle of white; and there were more left to such protection than there ought to have been, although not so many as we have sometimes seen. It is a strange thing that many farmers, after all the warnings that have been given them in books and periodicals, will still persist in leaving their root crops liable to be sacrificed to the weather. This year they have not the excuse of bad weather at lifting-time. The weather, as a rule, was all that could be desired for lifting and storing. We confess that we have no great sympathy for those who lose their turnips through leaving them too long in the fields. The long continuance of the frost and snow is beginning to make farmers somewhat uneasy now, as they are anxious to get the ground ready for spring-sowing and planting. Besides the fact that it must be some time after a fresh comes ere the ploughs are set agoing, there is the serious question of the melted snow, which, in many parts, cannot fail to make fields very plashy, bad to work, and not in good condition for the reception of the seed.

The storm has been in some places severe on hill stock, but, speaking generally, they do not appear to have suffered so much as could have been expected. The full extent of the injury, however, will not be known until the snow disappears, as many animals may be buried under it. Some have had to be brought down to the low grounds and fed on hay and turnips, and the condition of many must be considerably deteriorated in consequence of the storm. Turnips are lasting out much better than it was expected they would do at one time.

The new year has brought no improvement in the price of cereals, and indeed, if anything, taking the markets all over the country, they are lower than they were at the end of the year. Stock, however, keeps up, and even increases in price; and notwithstanding the high value of stores, fat cattle can still be sold at a profit by the feeder. The question of the supply of store-cattle is one that must soon force itself upon the serious consideration of farmers. (It will be found treated at some length in the first article of the Journal.) At present, store-cattle are very far from plentiful, and year by year they become scarcer and scarcer, and so they may be expected to do until more farmers devote themselves to rearing as well as feeding. How they can combine the function of breeder with that of finisher for the butcher, is a subject that might with propriety and profit be discussed at an early meeting of the Chamber of Agriculture and Scottish Farmers' Club. There can be no doubt at all that adequate remuneration for the outlay of agricultural capital is now to be looked for only from cattle and sheep. Unless some

great calamity, such as a foreign war, falls upon our country, there is no likelihood whatever that the price of corn will ever rise very much higher than it is at present. What farmers must do, therefore, is, if possible, to adapt their corn-growing so as to draw most profit out of it in connection with stock. It will not do to give up growing corn to the extent recommended by some; but there is little doubt, we think, that the area devoted to cereals is now too extended, and that it would be advantageous to lay down more land in permanent pasture.

Perhaps a little more might be done in dairy farming where the climate is suitable, as this branch of agricultural practice is just now very profitable in many localities. When in the vicinity of large towns, nothing pays better under skilful superintendence than milk and butter. We have heard lately of two dairymen in the neighbourhood of Edinburgh being enabled, in a few years, to save sufficient to take respectable-sized farms of their own. As we have just touched upon the great question of how to make farming more profitable, we may, with propriety, quote here from an agricultural newspaper, the *Scottish Farmer*, an account of a mode of sheep-management adopted by Mr M'Lagan of Pumpherston.

"As an instance of how much can be made out of sheep when managed with skill and liberality, we may mention that Mr M'Lagan has this year already realised for lambs out of two score of ewes 100 guineas. He has been selling lambs for nearly six weeks—the earliest lambs, so far as we know, which have found their way to the butcher from any breeder in Scotland. Latterly some of these lambs have been bringing as high as 49s.; and even at the beginning they each weighed some 7 or 8 lb. per quarter dead weight. The sheep from which Mr M'Lagan obtained these lambs are of the Dorset breed, which appear to be a hardy and tolerably prolific race, and have the reputation, which is fully justified by the butcher's experience of the lambs this year, of being 'capital killers.' These sheep lamb twice a-year; but Mr M'Lagan, in order to be first in the market, and like the early bird to catch the worm, only takes one crop of lambs from them. This year he was rather too early—lamb apparently not being considered a luxury in Scotland, or, at all events, not being deemed a profitable article of sale by the butchers at Christmas or New Year's-day. Next year, therefore, Mr M'Lagan proposes to keep his lambing-time back for about three weeks, as he calculates that he has lost something like that amount of keep on them this year. Instead, therefore, of having them lambing in the end of October, he proposes to keep them back until the third week in November. Out of the two score ewes, for which Mr M'Lagan paid £3 per head, he obtained forty-five lambs; but it should be stated that these were the product of thirty-five ewes only; the other five, having been injured by transit on the railway from the south, did not yield offspring. Up to the time of lambing, the ewes received nothing beyond grass, turnips, and such hay as was cut from the roadsides, ditches, &c. The cost of their keep for ten months before lambing is estimated at about sixpence a-week; and for the two months they remained with the lambs, when they were supplied with oil-cake, corn, and anything they could eat, about 15s. or 16s.—that is altogether for the year about 36s. This, multiplied by forty, the number of the ewes, gives us £72, which, deducted from £105, the value of the lambs, leaves £33 of clear profit, or 16s. 6d. per head. Not a bad profit, surely, when it shall have been augmented by the value of the wool and the manure.

"Of course, it must be understood that this favourable balance-sheet is not obtained without a great deal of trouble and care. Without intelligent management and a never-ceasing watchfulness, as large an item might easily appear on the debit side of the account. Neither can it be hoped, if many were to enter upon the field that Mr M'Lagan has opened up, that all, even with skilful superintendence, would be able to show a like gratifying result, for there is not sufficient scope here for many labourers. The demand for early lamb is limited, and an extra supply must of necessity reduce prices.

"When the ewes are about to lamb, Mr M'Lagan brings them into a courtyard, one side of which is surrounded with shedding, open in front and supported by wooden pillars, a field wall being taken advantage of for the back. After lambing, the ewes and their progeny are transferred to a closed-in shed roofed with asphalt, and which is sufficiently capacious to hold 102 pens (besides feeding-boxes), the smallest large enough for a ewe and a lamb, and the others adapted for a ewe with twins. The cost of this erection, which is upwards of 100 yards in length, and of breadth sufficient for two pens, with a road between, was only £80; here, again, advantage being taken of the outside walls of the cattle-byres. This shed is possessed of means for securing ample ventilation, which is very essential to the health of stock of all kinds. After the lambs are sold, their mothers remain a few days in the covered pens until their milk goes off them; they are then transferred to the court, where they remain for a week or two until they are acclimatised, as it were, to the cold, when they are let out into the field to resume the fare they had before lambing.

"Besides the ewes, Mr M'Lagan purchased a score of gimmers of the same breed, which have given him as many lambs. These he proposes to keep for stock.

"This experiment has not of course been prolonged enough to enable one to pronounce conclusively as to the value of Dorset sheep, but this much may be said for them, that they promise fair."

Returning again for a moment to the markets, we may mention that potatoes have been selling at higher figures since the frost commenced. Whether or not there is any truth in the theory sometime ago broached by an agricultural newspaper, that potatoes became higher in cold weather owing to the fact that the London poor were then obliged to have fires, which they dispensed with when the weather was more mild, and that, thus having the means of cooking potatoes, they bought them and ate them in preference to the dry bread they used when fire was not absolutely a necessity, we cannot say, but the fact that potatoes are generally higher in frosty weather gives an air of probability to it. The price Dunbar regents are fetching at the King's Cross market, which is higher than either Southwark or the Borough and Spitalfields, is from 106s. to 115s. per ton, which means about 20s. or 25s. less to the farmer. These are extreme rates, however; but regents in East Lothian are now bringing about 14s. per boll of 4 cwt. at the pits. This is a very much better price than was obtained last year; but then the crop this year was not nearly such a productive one. But there is no disease worth naming, and altogether they will, notwithstanding the less yield, pay better than last year.

The 'Mark Lane Express' yearly gets up elaborate statistics from

all the counties in England as to the produce of the crops, from which the following summary is derived :—

“ It is necessary to say that the averages of grain are assumed to be as follows :—Wheat 4 qrs., barley 5 qrs., and oats 6 qrs., per acre. In regard to potatoes there is no standard to guide us ; but this is of less importance, as not more than three or four of the returns mention the amount, merely naming ‘average,’ and ‘over,’ or ‘under,’ as the case may be. The following is the table of the actual results :—

UNDER AVERAGE.				OVER AVERAGE.				
	‡ Crop.	‡ to ‡.	Under.	Average.	Over.	‡ to ‡.	‡ Over	Total.
Wheat, . .	21	33	116	259	114	27	9	579
Barley, . .	10	62	51	228	188	13	14	566
Oats, . .	30	65	258	132	29	17	2	532
Potatoes, . .	16	19	182	269	30	8	—	530

“ In looking over these figures, the wheat crop stands in a much better position than might have been expected in regard to yield, the number of returns ‘under average’ being nearly balanced by the ‘over ;’ whilst the full ‘average’ crops form more than half the total. On the other hand, the quality of the grain of the late harvest is superior on the whole to that of the harvest of 1863, as the weight is above the average. These facts are gathered not only from the general tenor of the returns, but from every country miller consulted on the subject, many of whom declare that the quality has never been surpassed.

“ The barley crop is better than the wheat, there being 215 ‘over’ to 123 ‘under’ average ; whilst the full averages amount to 228, making 443, against 123 deficient. The quality, however, varies considerably ; and as a strong proportion of the barley crop will not be fit for malting, it must be used for fattening, for which purpose there will be a large demand. The low price of this grain is the natural consequence of the proportion of inferior quality, the best kinds still bearing a price proportionate to that of wheat, although a large amount of foreign barley is arriving almost weekly.

“ The oat crop was much the most deficient of the whole harvest, there being 353 returns ‘under’ against 48 ‘over’ average, and only 132 ‘averages.’ The drought of the last summer appears to have affected this grain much more than the barley. Fortunately, it is a crop generally of only secondary importance in England, being chiefly cultivated over a small acreage for home consumption.

“ The potatoes suffered to a considerable extent on the very light land from the drought, so far as the yield was concerned ; but, on the other hand, the quality of the tubers never was surpassed in goodness ; and the disease was so slightly developed as to be of very little consequence to the general result. The quality of the crop will make some amends for the deficiency in the yield, although the number of returns of ‘under average’ is 217, against 44 ‘over ;’ but, on the other hand, the full ‘averages’ amount to 269 ; so that we have 313 against 217, with a very small proportion of defective tubers.”

With regard to the Scotch crop, the firm of M’Lean & Hope

Edinburgh, who were at considerable pains to ascertain accurately its condition, say in their Annual Catalogue:—

“The dryness of the season told severely upon the hay crop, which was scarcely above half an average.

“In East Lothian, wheat is beyond question an average crop, both as respects quantity and quality, and Mr Hope of Fenton Barns even describes it as a full average. The average weight per bushel is stated to be 63 lb., although, doubtless, when the wheat has been got into good thrashing condition, many samples will far exceed this; the average yield will be 40 to 50 bushels per acre.

“In Mid and West Lothian an average crop has not been attained, and the quality varies very considerably. As to the weight per bushel, Mr Gibson of Woolmet states it would be, ‘if in condition, 62½ lb., but the condition is still raw,’ and the produce generally will not exceed 30 bushels per acre. In the southern districts we have Mr Usher of Stodrig’s report, ‘That wheat was thin on the ground, fair average quality, weighing 62 lb. per bushel.’ Mr Clay of Whinfield reports from another part of the same district that there is an average crop, 30 bushels per acre, but of inferior quality, and not in good condition. Generally the yield in Berwick and Roxburgh shires, on a diminished acreage occupied by wheat, is estimated at 25 to 30 bushels per acre. In Moray and Ross shires, and over the wheat-growing districts in the counties of Stirling, Fife, and Perth, the average yield will not exceed 24 bushels per acre, of 61 lb. per bushel. We have thus, on the whole, rather under an average crop of wheat; and there is everywhere a great shortcoming in the straw.

“Rarely, indeed, have the reports as to any one crop been so uniformly favourable as they are this season regarding barley, which seems to have thriven in the dry, warm weather so trying to some other products; and we are not exaggerating when we assert that the quantity of barley grown in Scotland this year exceeds that of any season on record. In East Lothian the estimated yield per acre is 60 bushels; in Mid-Lothian, 50 bushels; in the south of Scotland, and also Morayshire, Ross-shire, and the other northern counties where barley is grown, 45 bushels is probably under the average produce. The quality is generally very fine, and the weight from 56 to 58 lb. per bushel.

“With regard to oats, though short in the straw, the crop was a thickly-planted one, and, in point of fact, the yield, while far short of last year’s, and even beneath an average, is unquestionably much better than could have been expected in the month of July or August. The crop, moreover, was not uniformly deficient. In the highly-farmed districts of the Lothians it did fall considerably short, and we find Mr Henry Deans estimating the average produce at only 32 bushels. We are, however, inclined to think this an under-estimate. Mr Steedman of Boghall, while stating the ‘quantity and quality’ to be ‘much below an average, with straw about half the bulk of last year,’ refrains from giving an opinion as to the *bolls* per acre; and the thrashing-mill has brought out facts that agreeably surprised many who judged of the grain by the bulk of straw in stacks. In Banff, Aberdeen, and other counties where oats form the staple produce of the arable farmer, the crop is admittedly a full average, although in many districts the rains of September have affected the condition of the grain. In the view of all the information we have thus collected from all parts of Scotland, we feel justified in estimating the crop at 35 bushels to the acre. The quality and weight per bushel will be deficient, and samples above 44 lb. will be exceptional, while 42/43 will be the average weight.

“Beans and pease promised a very large crop at blooming time, but suffered from fly; they will still, however, be up to an average yield. Tares also, where allowed to mature, have produced a large crop. In many instances,

however, they were cut down for fodder; and the marketable quantity will in consequence be less than last year. In the Lothians, however, we think there will be about an average quantity.

"Potatoes did not occupy their usual breadth, and suffered from cold and drought at an early stage, which checked the expansion of the tubers; and, consequently, the yield is much under last year, but is, notwithstanding, still about an average. Quality is very superior, with an entire absence of disease.

"Turnips.—Great fears were at one time entertained of this valuable crop, owing to the long continuance of dry weather, but they recovered very rapidly in the later autumn months, and are now not only admitted to be a fair, but are by many described to be a *fine*, crop."

The Sewage Question.—The old question of the utilisation of town sewage for agricultural purposes has, since the year commenced, been revived with more than usual enthusiasm. It has formed a subject for discussion before the Society of Arts and the London Corporation. Baron Liebig has written a long letter about it, and Mr Lawes is to give his views of it to the members of the Royal Agricultural Society of England. The Baron's letter is an interesting contribution to the subject. Baron Liebig addresses his remarks principally to those "who look upon sewage as a nuisance, and who think it ought to be got rid of by any means, and the more quickly the better." "The true economy of his management that tells him which manures, and in what quantity, his field requires," the British farmer, according to this high chemical authority, "is as yet unacquainted with; and this is the reason why he is almost unable to estimate the worth of sewage. This, however, he will soon appreciate when experience teaches him its effects." After giving a detailed account of the constituents of sewage, the Baron remarks:—

"The chief value of sewage lies in this, that by its application the effects of phosphates, guano, and stable-dung are made sure and lasting, and the crops raised to that maximum which the soil can produce; because, by means of sewer-water, those elements are given which are wanting in the three other manures, or are present in them in but small quantities.

"Fifteen years ago, when the property of soils to absorb manure was as yet unknown, it would hardly have occurred to any one to employ sewer-water for manuring a field, for the great dilution of the liquid would have been considered an objection rather than otherwise. Now that we know such dilution has no effect on the accumulation of manurial matter in the earth, we look on this very circumstance as the *indispensable condition* for making the voidings of men and animals in towns available for agriculture. For it is only in this diluted state that it would be possible to put them in motion by means of machinery, and conduct them to those localities where they are to be employed. The old system of cesspools seems to us now a far greater hindrance to their utilisation, as their contents had to be carried from the towns to considerable distances by carts and horses.

"Many persons fear that, by the employment of sewage for manure, the air will be poisoned by the stench; that many districts will thus be rendered uninhabitable; that a residence in the country will thus lose one of its chief benefits, the enjoyment of pure unsullied air; and that many a neighbourhood, otherwise healthy, will be rendered feverish and pestilential.

As to the smell, every one knows that stable-dung is not less odorous than sewer-water; and the inhabitants of *London*, living near the *Thames*, are aware that it is only when the river is low, and in summer especially, that it affects them as a stream of diluted sewage. These fears about the stench will at once vanish if the simple experiment be made of bringing the most stinking sewer-water in contact with earth. It is astonishing with what magical quickness the bad odour vanishes the moment the liquid has penetrated into the soil. As to generating fever, the fear is not groundless with regard to those places which are converted into bogs by inundating them with sewer-water; the authorities, however, will hardly allow so senseless a manipulation to be continued."

Baron Liebig expresses an opinion about the effects of sewage-water upon meadow grass which will surprise some people; and no less surprising is his statement, that it can be more profitably applied to corn than to grass crops, seeing that almost our only knowledge of its fertilising properties is derived from our experience with it on grass. He says:—

"One thing is certain, and that is, a good meadow, over-manured with sewage, may become very bad if the soil favours too great an accumulation of ammonia, which, beyond a certain limit, acts like poison on the tender grasses abounding in saccharine matter.

"The full value of sewage, and of its separate constituents, can only be got out of it when it is employed on arable land. While, in the case of a meadow, the whole of that which has been taken from it in the harvest and sold must be replaced in order to make the yield constant, it is sufficient, in the system of farmyard manuring, to give the farmyard manure those ingredients in addition which were taken from the ground, in the preceding harvest, in the seeds and meat sold. The component parts of the straw remain on the farm, and therefore need nothing to replace them.

"By means of Peruvian guano and phosphates, the farmer replaces only a portion of these constituents. By means of sewage, on the contrary, he is fully enabled, with the proper addition of phosphates, to restore *all* of them to his field, and to increase those particular ones which the field most wants for giving higher and more constant crops. Sewage, as a never-failing source of ammonia, will prove to him of the greatest value when the supply of Peruvian guano is at an end."

Agricultural Education is another matter which, for some time past, has occupied the attention of the English and Scotch Societies, and has been brought more prominently before the public during the last quarter. There has been a good deal of what appears unnecessary heat and feeling on the part of those who hold different opinions on the subject in the English Society, and it is quite evident that the matter must be more thoroughly ventilated before any available and useful practical scheme is resolved upon. The Highland and Agricultural Society have adopted a report on the matter, which may on the whole be said to be sensible, and the scheme may be improved by experience. The Report, which is said to have been drawn up by a no less eminent person than the President of the College of Justice, is the joint production of the Council on Education and a Committee of the Directors. The following are the recommendations of the Report:—

"The Council and Committee have carefully considered how the Society can most effectually promote agricultural education, and they now beg to submit the following suggestions for the consideration of the Directors :—

"1st, That the compulsory observance of a curriculum should be dispensed with, and that any course of study to be indicated should merely be suggestive, and for the information of students.

"2d, That the rule which at present requires two separate periods of two years each to be devoted to classes and to the farm respectively should be repealed, and that no certificates of attendance at either be required.

"3d, That the possession of the required knowledge shall be deemed a sufficient qualification for a candidate, and that this should be determined solely by examination. That the examination should be both written and oral ; that the value of the answers should be determined by numbers ; and that the oral examination should be public.

"4th, That there should be two examinations, to be styled respectively the Certificate Examination and the Diploma Examination—the first to be open to candidates not less than eighteen years of age, the second to those who have completed twenty-one years.

"5th, That to pass the Certificate Examination, a candidate must be acquainted with farm accounts, mensuration, and surveying, and must possess a good knowledge of practical agriculture, and a general acquaintance with the elements of botany, chemistry, and natural history.

"6th, That a certificate in the following terms, signed by the President or Vice-President of the Council on Education, and by the Secretary, should be granted to candidates passing this examination :—' We hereby certify that A. B. has been examined, and has been found to possess a knowledge of farm accounts, mensuration, and surveying, a good knowledge of practical agriculture, and a general acquaintance with the elements of botany, chemistry, and natural history, and that he is therefore entitled to present himself for the further examination, in terms of the regulations, for the Society's diploma.'

"7th, That candidates who possess this certificate, and have completed their twenty-first year, should receive the diploma, if found, on the final examination, to possess a thorough knowledge of the theory and practice of agriculture ; of mechanics and mensuration ; of the physiology and treatment of domesticated animals ; and of the applications of botany, chemistry, and natural history to agriculture.

"8th, That a sum not exceeding £100 per annum should be placed at the disposal of the examiners to be applied in prizes—the number and amount of which shall be afterwards fixed—to candidates who pass with distinguished merit, and on a standard exceeding that required for the diploma."

The reporters hold the opinion that the plan here suggested will tend to stimulate agricultural education. We have seen it remarked that the masters ought to have a certain sum also for every pupil that distinguished himself ; but the teacher ought to, and no doubt would, find his reward in the increased pupils which the publication of his name as a successful tutor would bring into his school. The arguments which the reporters urge against entertaining a plan for bringing the Society into direct relationship with provincial or parochial schools seem very satisfactory. If, say they,

"Prizes were to be offered, as has been suggested, to such schools, it would be difficult to regulate the number or determine the status of the seminaries which should be entitled to claim them. Any attempt to draw a line of demarcation might appear invidious, and would be unpopular, and expose the

Society to imputations of partiality. On the other hand, if no such line were fixed, the Society would, in all probability, find itself exposed to demands which could not be refused without giving offence, and which, if complied with, would encroach unreasonably on the resources of the Society. The offer of a prize involves likewise the necessity of an examination in each case, at the instance of the Society itself; and though the gratuitous and valuable co-operation of the learned Professors, and the other gentlemen who constitute the Board of Examiners, will enable the Society to conduct the proposed certificate and diploma examinations in Edinburgh, the extension of a system of examination to the provinces would necessitate a staff far beyond that which it is in the power of the Society to organise."

The Malt-Tax.—Very large and influential meetings have been held in England during the past few weeks to promote the repeal of the malt-tax, which, it is thought, acts injuriously on the interests of the farmer, in so far as it prevents him, except under circumstances which are, in many districts, practically prohibitory, from malting inferior barley for the use of his cattle, a practice which it is stated by eminent and much-respected agriculturists to be a highly beneficial one. A meeting was held in London in the second week of February, which embraced the *élite* of the speakers at most of the previous provincial meetings, and was attended by other men of influence from all parts of the country. Many Members of Parliament were among those present. The speeches were all strongly in favour of the abolition of the tax, and many arguments were used to show that it was particularly obnoxious to farmers. The revenue obtained from this tax is some five or six millions, and if this were subtracted from the Exchequer funds another tax must be imposed, unless, indeed, the condition of the country was such as would enable the Chancellor to dispense with it altogether. We are not quite sure ourselves whether the farmer would derive so much special benefit from the repeal of the tax as the enthusiasm of some of the speakers would lead us to believe. Another plea for the abolition is made on behalf of the industrious poor, who, it is said, would be much more moral and healthy were they enabled to brew their own beer, duty free, than they are now, when they have to purchase it from the beer-house. In proof of this, a clergyman at the meeting adduced the case of a village, on Lord Radnor's property, where every one who chose to make beer at home had the malt, duty free, his lordship defraying the cost of the excise. In this village, it was said, the men and women were remarkable for their sobriety, good behaviour and character; the women for their neatness, cleanliness, &c.; and as servants both were much run upon. After the metropolitan meeting, one of the largest deputations that ever waited upon an officer of state had an interview with the Chancellor of the Exchequer, who answered them somewhat curtly in the following terms:—

"He could assure them that when the proper time arrived—that is, what we think the proper time, viz. the close of the financial year—it will be

the duty of the Government, if they find themselves happily in possession of a prospective surplus, to make such proposals as seem to them, on full consideration of all circumstances, to be most just to the community at large, and in the community he need not say that a great class, an important branch of which is represented by the gentlemen he saw before him, must be included as a prominent part. He might add for their consolation that if Her Majesty's Government were not really inclined to do them justice, they were not altogether unprovided with the means in the House of Commons of securing justice for themselves."

Perhaps it was unwise in the Chancellor thus to defy, as it were, the opposition of so powerful a movement.

In London, during the same week, there were also two other meetings of an important agricultural nature—viz., one to induce Sir George Grey to rescind an order, which, in accordance with an Act of 1861, he had issued against the travelling of locomotives on public roads at other times than between the hours of twelve o'clock at night and eight in the morning. It seems that this order, which just now applies only to a district of Yorkshire, was obtained through the representation of a few justices of the peace, but that the great proportion of the landed interests, and the general population of the district, are in favour of locomotives being allowed to run. There cannot be a doubt that, if the order was extended to all parts of the country, it would be very injurious to the interests of owners of steam-ploughs; that, in fact, it is a practical tax upon them when in the hands of private individuals, and a virtual prohibition of them when employed by companies for letting out on loan. On all farms intersected by highways a vast amount of time would be wasted were the plough not allowed to be moved from one field to another except at such hours as are named in the order, and many more accidents would be likely to occur than there are at present, through the shifting of such machines in the dark. At the meeting, which was presided over by Lord Kinnaird, these and other arguments were used to induce Sir George Grey to rescind his order, but he did not give much encouragement to the deputation that afterwards waited upon him to hope for the withdrawal of his prohibition, though the grounds upon which he issued it appear to have been rather slight, there being scarcely any case of accident to support the prayer of those who craved it. His reply to a petition from the Chamber of Agriculture and Scottish Farmers' Club (which, by the way, promises to be a powerful and exceedingly valuable institution), was couched in much the same terms. We trust, however, that the Home Secretary may yet be advised to withdraw this annoying order. The other meeting to which we refer was one for erecting a memorial to the late John Fowler, whose memory well deserves such a testimony of respect from improving farmers in all parts of the country. It is proposed that the memorial should take the form of a benevolent institution—a very appropriate one, considering the character of the man.

Smut in Barley.—We make the following interesting cutting about this matter from a recent agricultural newspaper. It may prove a useful hint to some of our readers :—

“Some of our barley, after swedes, last crop, was affected with black heads or smut, notwithstanding that the seed was selected from prize samples kept in new sacks.

“On thrashing a 37-acre field so affected, I found the whole sample quite black and discoloured; and although weighing $57\frac{1}{2}$ lb. per bushel, it only brought 25s. 6d. per qr. at market. It so happened that a neighbour was thrashing barley of the very same description, with similar results; and one day his hummeller broke down when the stack was only half-finished, and the remainder was taken to market in its rough and unhummed state, and fetched some shillings more than the other.

“On hearing of this, I took the hint, and adopted the old-fashioned plan of putting the barley twice through the thrashing-machine, which has a high-speed drum. I did not use the hummeller at all; the sample was bright and fine; and I had a rise in price next market-day of 4s. per qr., and which has been since maintained. The reason is, like most other things, simple when known. The blighted heads remain unbroken by the thrashing-machine; but if put through the hummeller, they are beaten up into powder, and the entire sample is blackened.”

Agricultural Experiments.—A proposition is on foot just now for carrying out a number of experiments, carefully conducted, all over the country, with a view to determine certain vexed and unsolved questions connected with agricultural pursuits. Such a scheme promises to be of unusual value to practical and scientific agriculture, and we trust that it will be fully carried out. Dr Anderson of Glasgow is taking great interest in the matter, and will be glad to communicate any information about it to those who are interested. It is a movement that might be taken up with advantage by the Scottish Farmers' Club.

Law of Hypothec.—The Commission on this subject is taking evidence at great length, but a great portion of it is merely repetitive. The opinions of almost all farmers are strongly against the law; but as yet there is rather a want of facts before the Commission. However, it is a question that cannot be thoroughly discussed until the entire evidence has been published, and then it will want more elaborate treatment than can be given to it in a summary paragraph.

A Grain-binding Machine.—We have a new thing in farm machinery reported from America. The want of a machine to bind the grain has long been felt, and now it seems that it has been supplied. From the report we have had of it, it appears that the binder is a distinct machine from the reaper. It is said to effect a saving of something like 5 dollars per day. We have no description of its mechanical construction.

What is now needed is the combination of the reaping-machine and the binder.

AVERAGE PRICE OF THE DIFFERENT KINDS OF GRAIN,

PER IMPERIAL QUARTER, SOLD AT THE FOLLOWING PLACES.

LONDON.							LIVERPOOL.						
Date.	Wheat.	Barley.	Oats.	Rye.	Pease.	Beans.	Date.	Wheat.	Barley.	Oats.	Rye.	Pease.	Beans.
1864.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	1864.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
Dec. 3.	41 11	29 6	21 6	36 3	36 3	36 5	Dec. 3.	45 0	29 6	19 11	34 6	35 8	35 6
10.	41 5	30 10	20 9	30 6	33 0	37 4	10.	35 9	28 6	21 3	31 4	34 6	36 8
17.	39 9	28 9	21 11	28 0	36 4	37 9	17.	37 0	28 0	22 10	30 2	35 8	37 2
24.	40 7	27 11	18 4	30 6	43 9	36 8	24.	38 5	28 2	20 7	33 6	37 6	36 8
31.	40 5	30 7	18 5	30 0	36 5	35 8	31.	37 10	27 2	19 4	35 4	36 8	35 3

By the provisions of the Act 27 & 28 Vict. cap. 87, the Corn returns are restricted, from and after the 31st December 1864, to Wheat, Barley, and Oats, and to Towns from which returns were received under the Act 9 Geo. IV. cap. 60. The average prices have been ascertained to be practically the same whether computed upon returns from the larger or smaller number of Towns.

EDINBURGH.							DUBLIN.						
Date.	Wheat.	Barley.	Oats.	Pease.	Beans.		Date.	Wheat, p. barl. 20 st.	Barley, p. barl. 16 st.	Bere, p. barl. 17 st.	Oats, p. barl. 14 st.	Flour, p. bar 9 st.	
1864.	s. d.	s. d.	s. d.	s. d.	s. d.		1864.	s. d.	s. d.	s. d.	s. d.	s. d.	
Dec. 7.	37 9	25 0	18 4	35 6	36 1		Dec. 2.	22 6	14 4	12 6	11 0	16 9	
14.	36 8	24 7	18 10	35 8	36 4		9.	22 2	14 6	12 8	11 2	16 10	
21.	36 7	24 8	18 6	34 6	35 2		16.	22 6	14 3	12 6	11 0	16 10	
28.	37 2	24 8	18 8	34 4	35 1		23.	22 6	14 3	12 6	11 2	16 11	
1865.							30.	22 9	14 6	12 4	11 0	17 0	
Jan. 4.	37 2	26 0	18 9	33 8	34 6		1865.						
11.	36 6	25 4	18 7	34 2	34 11		Jan. 6.	23 0	15 0	12 6	11 2	17 0	
18.	36 7	25 10	18 10	34 10	36 0		13.	22 0	14 6	12 2	11 0	17 1	
25.	36 3	25 11	20 0	35 4	35 11		20.	22 0	14 6	12 0	10 10	16 10	
							27.	22 0	14 3	12 3	11 3	16 11	

TABLE SHOWING THE WEEKLY AVERAGE PRICE OF GRAIN,

Made up in terms of 7th and 8th Geo. IV., c. 58, and 9th and 10th Vict., c. 22. On and after 1st February 1849, the Duty payable on FOREIGN CORN imported is 1s. per quarter, and on Flour or Meal 4½d. for every cwt.

Date.	Wheat.		Barley.		Oats.		Rye.		Pease.		Beans.	
	Weekly Average.	Aggregate Average.	Weekly Average.	Aggregate Average.	Weekly Average.	Aggregate Average.	Weekly Average.	Aggregate Average.	Weekly Average.	Aggregate Average.	Weekly Average.	Aggregate Average.
1864.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
Dec. 3.	38 5	38 9	29 2	29 2	20 3	20 0	26 8	31 8	35 5	35 2	37 10	37 10
10.	38 4	38 8	28 8	29 6	19 10	19 11	26 7	30 11	34 11	35 2	37 2	37 8
17.	38 1	38 6	28 4	29 12	19 9	19 10	29 1	30 10	35 3	35 8	37 2	37 7
24.	37 10	38 4	28 0	28 10	19 1	19 9	30 4	30 5	35 6	35 2	36 3	37 4
31.	37 10	38 2	27 11	28 7	18 10	19 7		30 6	34 7	35 2	36 8	37 2
1865.												
Jan. 7.	38 2		27 10		19 3	Weekly averages for Wheat, Barley, and Oats only, in terms of the Act 27 & 28 Vict., cap. 87, and these are only now to be returned. The Import Duty on Corn is now 3d., on Flour 4½d., per 112 lb.						
14.	38 7		28 0		19 0							
21.	38 10		28 2		19 1							
28.	38 6		29 0		19 3							

FOREIGN MARKETS.—PER IMPERIAL QUARTER, FREE ON BOARD.

Date.	Markets.	Wheat.				Barley.				Oats.				Rye.				Pease.				Beans.			
		s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.
1864. Dec. ..	Danzig	20	0	24	0	14	0	20	0	11	0	12	6	17	0	23	0	24	0	26	6	26	0	30	0
1865. Jan. ..		20	6	24	0	14	6	20	0	11	6	13	0	17	6	24	0	25	0	27	0	27	6	30	6
1864. Dec. ..	Hamburg	21	6	27	0	15	6	20	0	12	0	14	0	20	0	23	6	24	0	27	6	28	0	31	6
1865. Jan. ..		20	6	26	6	15	0	20	0	12	0	13	6	19	6	24	0	25	0	28	0	28	0	30	6
1864. Dec. ..	Bremen	20	0	25	0	15	0	19	6	12	0	14	0	18	0	22	0	24	6	28	0	28	6	32	0
1865. Jan. ..		20	6	25	0	15	6	19	0	12	0	14	6	17	6	21	6	25	0	28	0	27	6	31	6
1864. Dec. ..	Königsberg	20	0	25	6	15	0	20	0	12	0	14	6	18	6	23	0	25	0	28	0	28	0	32	0
1865. Jan. ..		20	6	25	0	15	0	20	0	12	6	15	0	18	0	23	6	25	6	28	0	27	6	30	6

Freights from the Baltic, from 5s. to 7s. 6d.; from the Mediterranean, from 10s. 6d. to 15s.; and by steamer from Hamburg, from 6s. to 8s. per imperial qr.

THE REVENUE.—FROM 1ST OCTOBER 1864 TO 31ST DECEMBER 1864.

	Quarters ending Dec. 31.		Increase.	Decrease.	Years ending Dec. 31.		Increase.	Decrease.
	1863.	1864.			1863.	1864.		
	£	£	£	£	£	£	£	£
Customs	5,970,000	5,932,000	..	38,000	23,421,000	22,585,000	..	836,000
Excise	4,753,000	5,000,000	274,000	..	17,745,000	19,343,000	1,598,000	..
Stamps	2,293,000	2,223,000	..	70,000	9,252,000	9,468,000	216,000	..
Taxes	1,285,000	1,294,000	9,000	..	3,208,000	3,261,000	53,000	..
Post-Office ..	990,000	1,090,000	100,000	..	3,800,000	4,000,000	200,000	..
Miscellaneous	895,166	950,596	55,430	..	3,201,620	3,459,374	257,754	..
Property-Tax	2,132,000	1,580,000	..	552,000	9,800,000	7,999,000	..	1,807,000
Total Income	18,318,166	18,069,596	438,430	660,000	70,427,620	70,115,374	2,324,754	2,693,000
Deduct increase .....	..	..	..	438,430	Deduct increase ....	..	..	2,324,754
Decrease on the qr. ..	..	..	..	221,570	Decrease on the year ..	..	..	368,246

PRICES OF BUTCHER-MEAT.—PER STONE OF 14 POUNDS.

Date.	LONDON.				LIVERPOOL.				NEWCASTLE.				EDINBURGH.				GLASGOW.			
	Beef.	Mutton.	Beef.	Mutton.	Beef.	Mutton.	Beef.	Mutton.	Beef.	Mutton.	Beef.	Mutton.	Beef.	Mutton.	Beef.	Mutton.	Beef.	Mutton.	Beef.	Mutton.
1864. Dec. ..	s. d. s. d. s. d. s. d.	s. d. s. d. s. d. s. d.	s. d. s. d. s. d. s. d.	s. d. s. d. s. d. s. d.	s. d. s. d. s. d. s. d.	s. d. s. d. s. d. s. d.	s. d. s. d. s. d. s. d.	s. d. s. d. s. d. s. d.	s. d. s. d. s. d. s. d.	s. d. s. d. s. d. s. d.	s. d. s. d. s. d. s. d.	s. d. s. d. s. d. s. d.	s. d. s. d. s. d. s. d.	s. d. s. d. s. d. s. d.	s. d. s. d. s. d. s. d.	s. d. s. d. s. d. s. d.	s. d. s. d. s. d. s. d.	s. d. s. d. s. d. s. d.	s. d. s. d. s. d. s. d.	s. d. s. d. s. d. s. d.
1865. Jan. ..	8 0 8 6 8 3 9 0	8 3 9 0 8 3 9 0	7 9 8 6 8 3 9 0	7 9 8 6 8 3 9 0	8 0 8 9 8 6 9 0	8 0 8 9 8 6 9 0	8 0 8 9 8 6 9 0	8 0 8 9 8 6 9 0	8 3 9 0 8 6 9 0	8 3 9 0 8 6 9 0	8 3 9 0 8 6 9 0	8 3 9 0 8 6 9 0	8 3 9 0 8 6 9 0	8 3 9 0 8 6 9 0	8 3 9 0 8 6 9 0	8 3 9 0 8 6 9 0	8 3 9 0 8 6 9 0	8 3 9 0 8 6 9 0	8 3 9 0 8 6 9 0	8 3 9 0 8 6 9 0

PRICES OF ENGLISH AND SCOTCH WOOLS.—PER STONE OF 14 POUNDS.

ENGLISH.				SCOTCH.			
	s.	d.	s. d.		s.	d.	s. d.
Merino,	25	6	to 32 0	Leicester Hogg,	30	6	to 36 6
.. in grease,	20	6	.. 26 0	.. Ewe and Hogg,	24	6	.. 31 6
South-Down,	26	0	.. 32 0	Cheviot, white,	21	0	.. 26 6
Half-Bred,	21	6	.. 26 6	.. laid, washed,	14	6	.. 20 0
Leicester Hogg,	26	6	.. 32 0	.. .. unwashed,	12	6	.. 15 6
.. Ewe and Hogg,	23	6	.. 30 0	Moor, white,	12	6	.. 16 0
Locks,	11	6	.. 15 0	.. laid, washed,	9	6	.. 14 0
Moor,	9	6	.. 12 6 unwashed,	8	0	.. 10 6

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PHOSPHO GUANO.

Natural History, and Mode of Preparation.

THE PHOSPHO GUANO, in its natural state, is found in the form of hard crusts, on a group of trap-rock islets within the tropics. It was discovered in 1854; and its existence was first made known to the public in August 1856, when Dr VOELCKER read a paper, before the members of the British Association for the Advancement of Science, at Cheltenham, "On the remarkable composition of a new variety of Guano, called Columbian or Maracaibo Guano," pointing out its peculiar fitness as the base of a highly concentrated phosphatic manure. The specimens examined by Dr VOELCKER were taken from Monk's Island, in the Spanish Main; but other deposits, still richer in phosphates, have since been discovered, from which the importations are now received. It is one of the most remarkable natural substances; and is so far singular from the fact of its containing an excess of phosphoric acid compared with any other known phosphate. The phosphate of lime existing in it contains one equivalent less of base than is found in the phosphate of lime in bones, or other varieties of Guano. Hence the facility with which, by the aid of a comparatively small quantity of sulphuric acid, the phosphate of lime is converted into a soluble super-salt.

The Baron LIEBIG, in the course of his investigations, discovered Potash in the raw Guano, a discovery since confirmed by Dr VOELCKER and other Chemists. To the presence of this substance (which is not found in any mineral phosphate) is attributable, in some degree, the great superiority of the PHOSPHO GUANO when compared with other phosphatic manures made from coprolites, apatite, Sombrero Guano, &c.

PHOSPHO GUANO contains in its natural state nearly double the quantity of phosphoric acid found in bones and other substances from which Superphosphates are prepared. When imported, it is crushed and reduced by powerful machinery to a fine powder. It is then subjected to the action of sulphuric acid, to render the phosphates soluble; and a pure salt of ammonia is afterwards added, to supplement the quantity naturally existing in the raw Guano. The salts of ammonia are prepared by a patented process; and the whole of the ammonia present in the PHOSPHO GUANO is in a pure state, and in a readily available form for assimilation by the plant.

The effect of the application of PHOSPHO GUANO to both grain and root crops has borne out, most truthfully and satisfactorily, the character given to it by LIEBIG and VOELCKER. Whether used to assist the growth of grain or roots, or applied as a top-dressing to grass lands, it is found to produce, beyond all other manures, the greatest amount of the food properties of the plant, and that with a marked superiority of quality. The beneficial effect of the PHOSPHO GUANO on the *second* and *third* year's crops is also very marked; and in this respect it is unequalled.

PHOSPHO GUANO, being a very highly concentrated manure, requires, before being used, to be mixed with an equal weight of wood ashes, sand, or dry earth, so as to insure its equal distribution. Treated in this way, it becomes the cheapest manure in the market.

Comparison of Phospho Guano and Peruvian Guano.

On the first introduction of the PHOSPHO GUANO, Professor VOELCKER pronounced it to be "by far the most valuable fertiliser, whether natural or artificial, which has yet been offered to the public;" and seven years' practical experience in the field has proved the correctness of the learned Professor's opinion. Still more emphatic is the testimony of the Baron JUSTUS VON LIEBIG, who says, "I never have had in my hands a manure which, in regard to the best proportions and abundance of efficacious soluble component parts, was to be compared to the PHOSPHO GUANO. The PHOSPHO GUANO surpasses most certainly, by its more correct and constant composition, the *best sorts* of Peruvian Guano, and of its *superior efficacy* there can be not the slightest doubt."

One of the most important advantages of the PHOSPHO GUANO is its *uniform* composition, and in this particular it is equalled by no other manure; there being none whose composition does not vary greatly in different samples, even when drawn from a comparatively small bulk. Peruvian Guano, for example, in a *perfectly genuine form*, shows very great variations in its composition and value. Attention was first drawn to this fact in the "Elements of Agricultural Chemistry," published in 1860. Samples of Peruvian Guano have been analysed differing in value to the extent of nearly £3 per ton; in exceptional cases samples not worth more than two-thirds the price of good Peruvian Guano have been offered in the market; and differences in value of £1 or £2 per ton are of common occurrence.

PHOSPHO GUANO, on the other hand, is more uniform than Peruvian Guano; the only variation ever found in it being (as compared with its recognised standard) an addition to its most valuable properties, and a consequent diminution of its less valuable constituents.

As the PHOSPHO is the only Guano which enters into competition with the Peruvian Guano, it is of importance that the

farmer should clearly understand in what degree the two Guanos differ. The distinction may be thus pointed out:—

1. Peruvian Guano contains a large amount of nitrogen, partly as ammonia and partly in the form of uric acid, guanin, &c., coupled with a comparatively small quantity of phosphates, chiefly in the insoluble form.
2. PHOSPHO GUANO contains a much larger quantity of phosphates, principally in a soluble form, along with a moderate proportion of nitrogen, entirely in the state of salts of ammonia.
3. Owing to this difference, Peruvian Guano is suited only to those cases in which an abundance of nitrogen is required by the soil. It cannot be advantageously used as a source of phosphates; because whenever it is applied in quantity sufficient to supply an abundance of these substances, the quantity of nitrogen becomes excessive, and is liable to produce injurious effects.
4. In PHOSPHO GUANO the proportion of phosphates is so adjusted that it can be used without risk in very large quantities; and as the phosphates are by far the most important substances on most soils, it produces a good and profitable result in cases in which Peruvian Guano has comparatively little effect.

From the foregoing, it will be seen that the superiority of the PHOSPHO GUANO to the Peruvian consists in the favourable relation which exists between the phosphates and the ammonia, which makes it applicable as a manure in so many cases where Peruvian Guano could not safely be used.

Dr VOELCKER thus points out the difference between PHOSPHO GUANO and Peruvian Guano:—

1. PHOSPHO GUANO contains nearly the whole of its nitrogen in the form of readily available salts of ammonia. Peruvian Guano, on the other hand, contains the larger proportion of its nitrogen in the form of uric acid, guanin, and other nitrogenous substances.
2. Peruvian Guano contains uric acid, guanin, and oxalic acid. PHOSPHO GUANO does not contain a trace of any of these matters.
3. PHOSPHO GUANO contains nearly double the amount of phosphate of lime which is found in Peruvian Guano.
4. Nearly the whole of the phosphoric acid in PHOSPHO GUANO occurs in a state in which it is easily soluble in water, whilst only a small portion of the phosphoric acid in Peruvian Guano occurs in such a soluble state.
5. Peruvian Guano contains, in relation to its phosphatic constituents, an excessive proportion of ammonia, and organic matters yielding ammonia on decomposition; for which reason it is calculated to do harm when it is injudiciously used by the farmer. PHOSPHO GUANO, on the other hand, contains, in addition to a large amount of soluble phosphate, which is *always* beneficial to vegetation, an amount of ammonia which renders the application of PHOSPHO GUANO to the land less hazardous, and in many cases more beneficial than that of Peruvian Guano.

From the foregoing, it will be seen that the radical defect of Peruvian Guano is the relative proportions in which ammonia and phosphate of lime exist in it. It has *too much* ammonia, and hence is too stimulating: it has *too little* phosphate of lime, and hence does not add to the fertility of the land, or return to it those indispensable mineral elements, which repeated crops carry off. That its great excess of ammonia induces an over-growth of soft straw and of shrivelled grain in the cereal crops, and of a superabundance of foliage and a soft spongy bulb in root crops, is becoming generally acknowledged. In fact, it does not accomplish one of the primary objects of manuring—viz., to improve the soil; but, on the contrary, exhausts it, and, by repeated injudicious use, impoverishes it.

The PHOSPHO GUANO, on the contrary, according to Dr VOELCKER, being much richer in phosphates, and not containing so much ammonia as to cause too luxuriant a development of leaves at the expense of the bulb, is *much superior* to *Peruvian Guano*, as a manure for turnips, swedes, mangolds, and potatoes.

Equally emphatic is the opinion of Baron LIEBIG, who says that the result of his researches proves, that no manure has, as yet, come to his knowledge so rich in soluble phosphates, and other efficacious soluble ingredients.

Comparison of the Phospho Guano, with a Mixture of Peruvian Guano and Superphosphate of Lime.

Many farmers in this country are of opinion, that, as all the valuable elements of PHOSPHO GUANO are contained in Superphosphates and Peruvian Guano, it is much more economical to purchase these substances and mix them together. The fallacy of this has long been known to most farmers of intelligence; but there is still a large class, comprising agriculturists of considerable note, who maintain that such a mixture is quite equal in quality to the PHOSPHO GUANO, is more economical, and will produce as good results. This matter has consequently attracted the attention of the Baron LIEBIG; and the

result of his investigation, which will be found in detail at page 12, proves the extreme fallacy of such views. His general conclusions are, that in PHOSPHO GUANO there is more than *double* the quantity of *soluble* phosphoric acid than in an equal weight of a mixture of half Peruvian Guano and half Superphosphate; and that, by using PHOSPHO GUANO, the farmer conveys to his field 26 per cent more phosphoric acid than by a mixture of equal parts of Peruvian Guano and Superphosphate of Lime; and that "the advantage for the improved quality of the soil appears still more in favour of the PHOSPHO GUANO, if the quantity of *soluble* phosphoric acid is taken into consideration."

Reports by the Baron Justus Von Liebig, and Dr Voelcker.

When the PHOSPHO GUANO was first introduced to the farmers of this country, an analysis of it was published for the information of purchasers. As this analysis was immediately copied by unprincipled persons, for the purpose of disposing of worthless imitations of the PHOSPHO GUANO, it was withdrawn from circulation. Before the commencement of each season, however, samples have always been carefully drawn, from the stock prepared for sale, and analysed by the leading Chemists, whose Reports from time to time have been made public. From 1859 to the spring of 1863, no analysis, for the reasons stated, has been published.

With the view of inspiring still greater confidence in the PHOSPHO GUANO, and to furnish evidence that the bulk corresponded with the samples analysed, Dr VOELCKER and Dr ANDERSON were commissioned to proceed to Birkenhead, to examine the large stock of the PHOSPHO GUANO, prepared for season 1863, then lying in the Stores there, and, at the same time, to select samples for analysis. Both of these eminent Chemists having accomplished their mission, drew up special Reports. They also forwarded a portion of the samples thus drawn to the Baron JUSTUS VON LIEBIG, whose Report, together with Dr VOELCKER's, will be found at pages 10 and 13.

Commercial Value of Phospho and Peruvian Guano.

The Baron LIEBIG, Dr VOELCKER, and other Chemists of standing, have ceased to place a money value on manures submitted by them to analysis, as tending to lead to erroneous conclusions, owing to the disingenuous manner in which such values are paraded before the public eye by dealers; but for the information of those farmers who still have faith in this test, we may state that the money value of the PHOSPHO GUANO, calculated by the data hitherto in use by these Chemists, is, according to the mean average of the analyses, £14 per ton.

These figures show, by the only accepted test of money value, that the PHOSPHO GUANO is sold to the farmers at a price considerably below its commercial value, calculated according to the usual method. It must be borne in mind, however, that this estimate of the money value of PHOSPHO GUANO, founded upon its chemical composition, has been arrived at by valuing its ingredients at the same rate as if they were the elements of the most inferior kind of manure. But this valuation of the PHOSPHO GUANO, high as it is, does not indicate the actual practical value of the Guano, which, indeed, is greater than its mere analysis expresses; for the phosphates in Guano are of far more value than equal weights of the same ingredients in bones; while the fertilising constituents of bone superphosphate are, weight for weight, more valuable than the same ingredients in coprolite and other mineral superphosphates. It is, therefore, manifestly unjust to PHOSPHO GUANO to value its phosphates at the same rate as those of most of the ordinary superphosphates, which are either wholly or partly made from coprolites. It was at one time believed that soluble phosphate from every source is equally valuable; but, very recently, Dr VOELCKER, in the 'Journal of the Royal Agricultural Society of England' (Vol. xxiii.), exposes the fallacy of this. He says:—

"The fact is, the commercial value of soluble phosphate of lime, like that of many other materials, depends in some measure on the source from whence it

is derived, and the nature and the amount of other substances with which it is associated. Thus, soluble phosphates cannot be produced at as low a price when made from *bones* as from *mineral* phosphates. Then why not make it in the cheapest possible form ? is a question which naturally suggests itself, but which is answered by the fact that in many instances *bones* partially dissolved in oil of vitriol produces a better practical result on the turnip crop on light soils than a mixture containing an equivalent amount of soluble phosphate made from *coprolites* and insoluble bone phosphate. We thus see that it is not enough that there should be a certain amount of soluble and insoluble phosphate in a turnip manure ; but that the *very source* from which the fertiliser is obtained, affects its *agricultural* as well as its *commercial* value."

It follows, then, according to the conclusions of Dr VOELCKER, that the phosphates of the PHOSPHO GUANO are, on account of their *origin*, of far greater commercial value than the same elements in ordinary Superphosphates, which are, with some exceptions, either wholly or partly made from coprolites and other similar mineral bodies.

In regard to the money value of Peruvian Guano, the Baron LIEBIG, so recently as the 19th January last, writes as follows:—

"The best sorts of Peruvian Guano contain on an average $8\frac{1}{2}$ per cent of ammonia, 12 per cent of phosphoric acid ($\frac{1}{4}$ soluble and $\frac{3}{4}$ insoluble), and 0.6 per cent of potash, and accordingly the value of 2240 lb. is as follows:—

One ton of Peruvian Guano contains—				
Ammonia	190 $\frac{1}{2}$ lb.	at 6.6 pence	.	1257 pence.
Phosphoric Acid	{ 67 " soluble	" 3.21 "	.	215 "
	{ 201 " insoluble	" 1.6 "	.	322 "
Potash	13 $\frac{1}{2}$ "	" 3.84 "	.	51 "
				1845 = £7, 14s.

This is the real value of one ton of Peruvian Guano of the said composition.

"The higher price that the farmer pays for it (£13, 10s.) is a fancy price which by some agricultural chemists is still maintained, to the evident detriment of the farmer. Their calculation is based on the supposition that certain matters contained in guano rich in nitrogen—for example, uric acid—possess fertilising properties measurable by its nitrogen. What we know is, that the residue of Peruvian Guano after lixiviation by water, and which contains the whole quantity of uric acid and a certain quantity of earthy phosphates, has little effect on vegetation ; not more than may be ascribed to the phosphates and the very small remaining quantity of ammonia.

"In calculating the value of a manure, it seems to me to be inadmissible to give to matters a market value as long as their effects are unknown, and which at all events are so slow that the farmer derives no corresponding advantage from their use ; he ought to spend his money only in the purchase of such matters, the effects of which are known and perfectly certain."

Introduction of Phospho Guano.

The introduction of Peruvian Guano, it is well known, was attended with considerable difficulty; and fully seven years elapsed ere its merits were acknowledged by agriculturists. The active measures, however, taken in introducing the PHOSPHO GUANO to the farmers of Great Britain, supported by the opinion expressed by the leading agricultural chemists, of its great superiority to Peruvian Guano, caused it at once to be sought after. The result of careful experiments in the field having fully established this superiority, the consumption has increased year by year; and at the close of the eighth season, 1864, it has attained a position second only to that of Peruvian Guano.

Independently of its large sale in the United Kingdom, the PHOSPHO GUANO has gained a very high reputation in France, Holland, Germany, Italy, Spain, Russia, and Sweden; and in the West Indies, British Guiana, and the Mauritius it is rapidly superseding Peruvian Guano as a manure for the sugar-cane. In Ceylon it has been pronounced as the best manure for the coffee plant.

It was not until after very great consideration, and ascertaining the result of trials by some of our leading agriculturists, that we accepted the contract for the sale of the PHOSPHO GUANO. For although often urged to include the sale of manures in our general business, we refrained from connecting our names with any of the substances brought before the farmers of this country, from a knowledge of the fact that artificial fertilisers are of ever-varying character and value; and that, consequently, a dealer exposed himself to great risks with his customers, if the article supplied to them was not of precisely the same quality as the guaranteed analysis, on the faith of which bargains were made and sales effected.

The PHOSPHO GUANO, however, came before us, strongly supported by the opinions of our best chemical authorities, who agreed in pronouncing it to be a substance of unvarying charac-

ter, and unquestionably superior to Peruvian Guano. Such evidence justified, in the interests of agriculture, a most searching investigation into the alleged merits of this Guano. This investigation resulted in the conviction that PHOSPHO GUANO is really the most valuable manure which has yet been introduced to the farmers of this country; and, moreover, that it is a substance perfectly uniform in composition, and not subject to those variations in quality and value, which have tended so much to injure the prestige of Peruvian Guano.

Without hesitation, therefore, we entered into a Contract for its sale in Scotland, and subsequently in England also, which expired in 1862, but has been renewed for a further term of years, and now embraces the entire Continent of Europe.

It is unnecessary to add anything further; but we commend to the serious attention of agriculturists the subjoined Reports of the Baron JUSTUS VON LIEBIG and Dr VOELCKER, embodying, as they do, facts of so much importance in regard to the comparative values of the PHOSPHO and Peruvian Guanos.

PETER LAWSON & SON.

EDINBURGH, 1st February 1865.

A P P E N D I X.

I. REPORT OF THE BARON JUSTUS VON LIEBIG,

President of the Royal Academy of Sciences at Munich.

1. I am well acquainted with the manure called or known as PHOSPHO GUANO.

2. In the year 1860, I analysed several samples, taken at long intervals of time, of PHOSPHO GUANO, which was then called Phospho-Peruvian Guano, the results of which, together with my opinion as to its great agricultural value, I, in May of the same year, published in the 'Journal of the Agricultural Societies of Bavaria,' recommending the German farmers to make experiments for themselves with what beforehand promised to give better results than any other manure.

3. In the month of July 1863, I received from Dr AUGUSTUS VOELCKER, the Consulting Chemist of the Royal Agricultural Society of England, a sample of

PHOSPHO GUANO, duly certified by him as having been taken by himself from heaps of about 10,000 tons of the said manure; and at the same time, I received from Dr THOMAS ANDERSON, the Consulting Chemist of the Highland and Agricultural Society of Scotland, four samples of PHOSPHO GUANO, duly certified by him as having been taken by himself from heaps of about 10,000 tons of the said manure.

4. I subjected the four samples received from Dr ANDERSON, and the one sample received from Dr VOELCKER, to careful analysis, and the following result was arrived at:—

	Dr Anderson's Samples.			Dr Voelcker's Sample.	
	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.
100 parts contain—					
Phosphoric Acid,	19.451	18.375	19.203	21.613	19.144
containing soluble Phosphoric Acid, (16.945)		(17.728)	(17.728)	(20.795)	(17.04)
Ammonia,	3.314	3.420	3.885	3.515	3.410
Potash,	0.327	0.250	0.250	0.165	0.250

5. To the scientific man, the fact may not be uninteresting that the Guano which is employed as the base of the PHOSPHO GUANO contains potash—a circumstance which very materially distinguishes it from the phosphorites of Estremadura, Amberg, &c., which are not Guano deposits, but are of mineral origin. In the sample of the raw PHOSPHO GUANO as imported, sent to me by Dr VOELCKER, I find 0.799 per cent of potash.

6. I am well acquainted with the manure known as Peruvian Guano, and have for many years past been occupied in investigating its nature, action, and effect on the soil, and on the growth of crops.

7. Professor Way examined 78 samples of Peruvian Guano, and he found in 100 parts:—

	Mean.	Lowest.	Highest.
Phosphate of Lime, &c.	22.78	10.07	28.65
Organic Matter, and Salts of Ammonia,	52.05	45.17	59.00
containing Nitrogen,	(13.61)	(11.17)	(17.08)

My experience enables me to testify to the general correctness of these analyses. I found on the average 10 to 12 per cent of phosphoric acid, and 0.6 per cent of potash, in Peruvian Guano.

8. The quantity of nitrogen found in Peruvian Guano does not correspond to its equivalent of ammonia. The richest in ammonia contains very seldom more than *seven per cent*; the rest of the nitrogen is in the form of uric acid, guanin, &c., of the action of which on vegetation nothing is known.

9. Peruvian Guano is chemically distinguished from other sorts by two component parts—oxalic acid and uric acid. As these are always present in it, and not in other Guanos, it is not possible to mistake any other sort of Guano for Peruvian Guano.

10. Careful investigations have recently proved that the oxalic acid has a share in the efficacy of Peruvian Guano, inasmuch as by its means a part of the phosphoric acid becomes soluble, and thus is spread in the soil. Peruvian Guano, therefore, produces an effect much more speedily than other Guanos; and the favour it enjoys with agriculturists is owing chiefly to the quick diffusion of the phosphoric acid contained in it.

11. What the oxalic acid effects for the Peruvian Guano, is more perfectly attained in the PHOSPHO GUANO, by the sulphuric acid, which is added to it in the process of preparing it for the use of the farmers.

12. It is possible to form a mixture of soluble Guano phosphates with ammonia salts, not only in the proportion in which they exist in Peruvian Guano, but in far better and more favourable proportions, as is practically demonstrated in the case of the PHOSPHO GUANO.

13. As to the cause of the efficacy of Guano, opinion was for a long time di-

vided. At first it was thought that the efficacious effect was owing to the ammonia, or the amount of nitrogen which the Guano contained; and hence that from Peru, which was richer in nitrogenous elements, commanded a higher price than the other sorts, which were not so rich in them.

14. The experience gained in England, Germany, and other countries, has now, however, proved that it was an error to believe that the efficacy of the Peruvian Guano resulted chiefly from the amount of nitrogen it contained. On the contrary, the greater number of fields manured with Peruvian Guano have shown that, by the employment of this manure, very much more nitrogen is imparted to the field than is good for it, and that the excess of nitrogen the farmer thus conveys to the soil injures his fields, and unfits them for the culture of turnips and fodder plants. Many agriculturists, who at first lauded highly the Peruvian Guano as the best manure, employ it now no longer; others but in smaller quantities.

15. Very different is the estimate which experience has taught us to form of manures rich in phosphoric acid, as the PHOSPHO GUANO. These, as their application in all countries has shown, are the most necessary for the restoration of a field, and for increasing its crop. Their effect is sure, and the fields to which they are applied are bettered lastingly. From this point of view, it is now, I think, very easy to get a correct idea of the value of the PHOSPHO GUANO.

16. Of late many farmers employ with considerable success a mixture of Peruvian Guano with sulphuric acid. But a mixture of superphosphate of lime and Peruvian Guano has been found to be still better for the field, and more efficacious. This mixture is, however, in its turn far surpassed by the PHOSPHO GUANO.

17. Such a mixture of equal parts—that is to say, 50 parts of Peruvian Guano mixed with 50 parts of superphosphate of lime (containing 20 per cent of total phosphoric acid) contains—

In 50 parts Peruvian Guano,	3.5 Ammonia.
	0.3 Potash.
	5.5 Phosphoric Acid.
50 parts Superphosphate of Lime,	10.0 Do.
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Total Phosphoric Acid, 15.5	

The mean of the analyses of the PHOSPHO GUANO mentioned in paragraph 4 shows that this manure contains in 100 parts—

	Phospho Guano.	Mixture of equal parts of Peruvian Guano and Superphosphate of Lime.
Total Phosphoric Acid,	19.537*	15.5
Actual Ammonia	3.409	3.5
Potash	0.240	0.3
* Equivalent to Phosphate of Bones, 42.3.		

18. These figures show, that, in 100 parts of PHOSPHO GUANO, the farmer conveys to his field 26 per cent phosphoric acid more than by a mixture of 50 parts of Peruvian Guano and 50 parts of superphosphate of lime. The advantage for the improved quality of the soil appears still more in favour of the PHOSPHO GUANO, if the quantity of soluble phosphoric acid is taken into consideration.

19. The superphosphate of lime in commerce does very seldom contain more than 12 per cent, and most of them sold in England, not above 10 per cent of phosphoric acid in soluble state. The average quantity of soluble phosphoric acid which I found in Peruvian Guano does not exceed 3 per cent.

20. In a mixture of Peruvian Guano and superphosphate of lime there are

In 50 parts of Peruvian Guano,	1.5
In 50 parts of Superphosphate,	6.0
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Total Phosphoric Acid, . . 7.5 in soluble state.

21. In 100 parts of PHOSPHO GUANO are 19.537 (mean of analyses mentioned in paragraph 4) parts of phosphoric acid, of which 18.027 are easily soluble.

22. Consequently, in PHOSPHO GUANO there is more than *double* the quantity of *soluble* phosphoric acid than in an equal weight of a mixture of half Peruvian Guano and half superphosphate of lime. These figures establish, as I verily believe, the high value of the PHOSPHO GUANO.

23. I never have had in my hands an artificial manure which, in regard to the best proportions and abundance of efficacious soluble component parts, was to be compared to the PHOSPHO GUANO.

24. The PHOSPHO GUANO surpasses most certainly, by its more correct and constant composition, the *best sorts* of Peruvian Guano, and of its *superior efficacy* there can be not the slightest doubt.

JUSTUS BARON VON LIEBIG.

MUNICH, 11th September 1863.

II. REPORT OF DR VOELCKER,

Consulting Chemist of the Royal Agricultural Society of England.

1. I have been well acquainted with the manure known as PHOSPHO GUANO since it was first introduced into commerce. The first sample of PHOSPHO GUANO was analysed by me in December 1856, at which time it was known as Phospho-Peruvian Guano, and, in my report accompanying the analysis, it is described by me as much superior to Peruvian Guano as a manure for root-crops, for which it is the most valuable fertiliser, whether natural or artificial, which had been offered to the public. Subsequent analyses, and the result of practical experiments, have confirmed this opinion.

2. In August 1856, I read a paper before the members of the British Association for the Advancement of Science, at Cheltenham, "On the remarkable composition of a new variety of Guano called Columbian or Maracaibo Guano," pointing out its peculiar fitness for the manufacture of a highly concentrated phosphatic manure. The said Maracaibo Guano, I learned subsequently, formed the base of the PHOSPHO GUANO, which, I believe, was first introduced into commerce in December 1856, or the beginning of 1857.

3. I consider the remarkable deposit which constitutes the base of the manure called PHOSPHO GUANO, to be a true Guano deposit, and not a mineral substance, like Estramadura phosphate, or like Norwegian apatite.

4. Since 1856 I have analysed, from year to year, many samples of PHOSPHO GUANO sent to me by the importers, and also many samples sent to me, without the knowledge of the importers, by landed proprietors and tenant farmers. In all cases I found the manure what it professed to be, confirming my first report and statement: all the analyses showing that the peculiar character and valuable properties, which I first ascribed to the PHOSPHO GUANO, were well kept up.

5. In 1861, however, I observed a marked improvement in the proportion of soluble phosphate contained in it, accompanied with a larger quantity of ammonia, in the shape of salts of ammonia. I noticed the improvement to a still greater extent in 1863, when, in company with Dr ANDERSON of Glasgow, I was deputed to inspect the stock prepared for that year's consumption.

6. My visit to the works was on the 9th of January 1863, and on that date I saw a large bulk of the remarkable phosphatic Guano which forms the base of

the PHOSPHO GUANO, also the preparation of ammonia salts, with which the ammonia existing in the base is supplemented, and all the appliances for bringing the PHOSPHO GUANO into its present finely pulverised and uniform condition.

7. The manner in which the importers employ salts of ammonia to supplement the small quantity of ammonia naturally existing in the base of the PHOSPHO GUANO, incorporates with the manure more available ammonia in a given bulk, and enables the manufacturers to obtain, with greater certainty, and in smaller bulk, the quantity of ammonia they wish to add to their manure than any other process which could be devised.

8. The highly concentrated state and valuable fertilising properties of PHOSPHO GUANO, I attribute mainly to the excellency and peculiar chemical composition of the raw Guano deposit which forms the base of the manure, and to the great care and skill which is always observed in its preparation.

9. After inspecting the PHOSPHO GUANO Stores at Birkenhead, I drew up the following Report, a copy of which I, at the same time, sent to Messrs PETER LAWSON & SON:—

"In compliance with your request, I visited the Works and Stores of the PHOSPHO GUANO at Birkenhead on the 9th January 1863, for the purpose of drawing samples for analysis from any part of the bulk from which I chose to take them.

"After inspection of a large heap of the remarkable PHOSPHO GUANO, in the natural state in which it is imported, I proceeded to examine the whole of the bulk of the prepared Guano ready for delivery in 1863, and took the following samples:—

- No. 1. From a small heap of about 1000 tons.
- No. 2. From the top layer of a large heap of about 4000 tons.
- No. 3. From the middle of the same heap.
- No. 4. From the bottom of the same heap.
- No. 5. An average sample from the top, middle, and bottom of the same bulk of 4000 tons.
- No. 6. A sample taken from a third bulk of about 1200 tons.

"The samples No. 1 and No. 5, taken from a bulk of about 1000 and 4000 tons respectively, were submitted by me to a careful and complete analysis, which yielded the following results:—

	No. 1.	No. 5.
Water,	13.90	12.17
*Organic Matter and Ammoniacal Salts,	17.75	16.08
Bi-phosphate of Lime,	21.98	22.67
Equal to Bone Earth rendered soluble by acid,	(34.88)	(35.37)
Insoluble Phosphates (Bone Earth),	4.16	4.72
Sulphate of Lime (anhydrous),	36.90	38.51
Alkaline Salts,	2.54	2.32
Insoluble Siliceous Matter,	2.77	3.53
	100.00	100.00
* Containing Nitrogen,	2.77	2.96
Equal to Ammonia,	(3.36)	(3.59)

"The composition of these samples, taken from the two heaps, exhibits a close agreement in almost every particular, showing that a uniform process is employed to convert the raw material into an efficacious portable fertiliser.

"In order to test still further whether the bulk ready for delivery was of as uniform a composition as could be desired, I determined the amount of soluble and insoluble phosphates in two separate portions of each of the following samples, and obtained the following results:—

Per cent of Soluble Phosphates (i.e. Bone Earth rendered soluble).										Insoluble Phosphates (Bone Earth).	
No. 2.	{	35.41	.	.	.	.	.	.	.	4.01	No. 2.
		35.61	.	.	.	.	.	.	.	4.33	
No. 3.	{	35.16	.	.	.	.	.	.	.	5.85	No. 3.
		34.70	.	.	.	.	.	.	.	5.51	
No. 4.	{	35.29	.	.	.	.	.	.	.	4.97	No. 4.
		36.09	.	.	.	.	.	.	.	3.66	
No. 6.	{	36.93	.	.	.	.	.	.	.	1.50	No. 6.
		36.83	.	.	.	.	.	.	.	2.04	
Total average, 35.75										4.11	

"These results are highly satisfactory; for they show that great uniformity in composition prevails in all the samples taken by myself indiscriminately from various parts of the bulk.

"Having repeatedly expressed an opinion of the high value of PHOSPHO GUANO, I may safely avoid repetition, and you may remain satisfied, that as long as this fertiliser is offered for sale in as good a condition, and in as concentrated a state as that of the bulk for 1863, it will maintain a high character as an artificial manure."

10. PHOSPHO GUANO contains nearly the whole of its nitrogen in the form of readily available salts of ammonia. Peruvian Guano, on the other hand, contains the larger proportion of its nitrogen in the form of uric acid, guanin, and other nitrogenous substances.

11. Peruvian Guano contains uric acid, guanin, and oxalic acid. PHOSPHO GUANO does not contain a trace of any of these matters.

12. PHOSPHO GUANO contains nearly double the amount of phosphate of lime which is found in Peruvian Guano.

13. Nearly the whole of the phosphoric acid in PHOSPHO GUANO, amounting to about 19 per cent (which is equivalent to about 42 per cent of bone phosphate), occurs in a state in which it is easily soluble in water, whilst only a small portion of the phosphoric acid in Peruvian Guano occurs in such a soluble state.

14. In PHOSPHO GUANO a large amount of soluble phosphates is combined with an appropriate and fair proportion of ammonia. In Peruvian Guano a much smaller total amount of phosphates, and, compared with PHOSPHO GUANO, quite an insignificant amount of soluble phosphates, is associated with a large and excessive amount of ammonia and nitrogenous organic matters capable of yielding ammonia on decomposition.

15. Direct experiments in the field, carried on for many years, have shown me that highly nitrogenised manures, or of fertilisers containing more than 5 or 6 per cent of ammonia, require to be used with great caution, inasmuch as such a proportion of ammonia in a manure is prejudicial when a heavy dressing of the manure is put upon the land. On some soils even less than 4 per cent of ammonia is calculated to do more harm than good, especially when used for turnips, carrots, and root-crops in general.

16. In field experiments, which extend over a number of years, I find that an excessive application of soluble phosphate, like that found in the PHOSPHO GUANO, never does harm, but invariably increases the fertility of the land. By using three or four times as much soluble phosphate as would be employed in practice on the most liberal dressing of a phosphatic manure, no injury, but a most decidedly beneficial effect was produced upon the crops under experiment.

17. My own experiments are fully confirmed by the experience of farmers throughout the country. No one at all acquainted with agricultural chemistry and the experience and usages of the agriculturist, in reference to manures, will hesitate to state deliberately that a large dose of ammonia or of nitrogenous organic matter may, and often does, produce evil effects upon our farm crops, whereas the most liberal application of a manure like the PHOSPHO

GUANO, rich in soluble phosphates, is invariably attended with the most beneficial results.

18. As pointed out already, Peruvian Guano contains, in relation to its phosphatic constituents, an excessive proportion of ammonia, and organic matters yielding ammonia on decomposition; for which reason, it is calculated to do harm when it is injudiciously used by the farmer. PHOSPHO GUANO, on the other hand, contains, in addition to a large amount of soluble phosphate, which is always beneficial to vegetation, an amount of ammonia which renders the application of PHOSPHO GUANO to the land less hazardous, and in many cases more beneficial than that of Peruvian Guano.

19. One or the other, or all these different facts, ascertained by scientific and practical field experiments, have operated already to a large extent to impair the value of highly nitrogenous manures, such as Peruvian Guano, and other purely ammoniacal fertilisers, and to give an unusual impetus to the manufacture and sale of phosphatic manures. I have no doubt in my own mind that the sale of the PHOSPHO GUANO and other phosphatic manures, large as it is already, will extend from year to year; whilst the exclusive application to the land of Peruvian Guano, and other manures very rich in nitrogenous matters or ammonia, will diminish in a corresponding degree.

20. I sent to the Baron JUSTUS VON LIEBIG, of Munich, in the month of July last, an average sample of the PHOSPHO GUANO, taken by me from the stores at Birkenhead in January last; and I have seen the Report made by him on same. I concur substantially with the views expressed in that Report; and, in regard to the value of ordinary superphosphates as compared with the PHOSPHO GUANO, my experience enables me to state that farmers who have been in the habit of using four or six cwt. per acre of ordinary superphosphates, of average quality, will find half the quantity of PHOSPHO GUANO, properly mixed with ashes or sand, quite as effective, if not more so.

21. In conclusion, I am of opinion that PHOSPHO GUANO is a uniformly prepared, highly concentrated, and more generally useful manure than the higher-priced Peruvian Guano. For root-crops it is, as I have before said, by far the most valuable fertiliser, whether natural or artificial, which yet has been offered to the public.

AUGUSTUS VOELCKER.

LONDON, 23d November 1863.

